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1961

CANAL OR RAILROAD?

IMITATION AND INNOVATION IN THE RESPONSE TO THE ERIE CANAL IN PHILADELPHIA, BALTIMORE, AND BOSTON

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THE AMERICAN PHILOSOPHICAL SOCIETY
INDEPENDENCE SQUARE
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PREFACE

This study has benefited immensely from the encouragement and numerous suggestions of Professor Carter Goodrich of Columbia University. Discussions with Professor Sigmund Diamond and a ruthless examination of its principal thesis by the members of the Industrial Countries Center of the Graduate Economics Research Centers at Columbia helped to clarify its concepts. A doctoral dissertation fellowship from the Ford Foundation under its Program in Economic Development and Administration facilitated its completion.

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CONTENTS

	PAGE
I. Introduction	5
PART I. PENNSYLVANIA:	
II. Prelude to a crucial decision	15
The consequences of the decision	15
Prelude to the debate, 1786–1825	19
III. The railroad versus the canal	
The technical and cost issues	29
Characteristics of the railroad	29
Mode of construction of railroads	34
Construction costs	35
Operation and repair	37
The portage issue	38
The experience issue	38
The analogy with the Erie Canal	38
The canal and railroad record	41
Experience versus experiment	45
The postponement proposal	47
IV. Causes of the decision	48
Why did they not postpone?	48
Mania versus the mountains	52
Vested interests	55
Summary and conclusions	56
V. After the debate	57
From mainline canal to Pennsylvania Railroad	57
Regrets and re-evaluations, 1826–1830	60
PART II. BALTIMORE:	
VI. The canal versus the railroad in the Potomac Valley	63
Baltimore and the canal project	63
Origins of the Baltimore and Ohio Railroad	69
VII. The Baltimore and Pennsylvania decisions compared	72
Differences in technology and experience	72
The United States Board reports	73
The geographic factor	74
The leadership factor	75
PART III. MASSACHUSETTS:	
VIII. The canal versus the railroad	80
The canal and railroad proposals to February, 1827	80
Technical and cost criteria	84
The experience criterion	86
IX. The delay of the railroad	88
The decision for a short-range railroad	88
The decision for an interregional railroad	92
The willingness to postpone: Summary and conclusions	94
Appendix: Summary description of the Trans-Appalachian projects	97
Bibliography	98
Index	104

I. INTRODUCTION

> There are no necessities, but everywhere possibilities; and man, as the master of possibilities, is the judge of their use. This, by the reversal which it involves, puts man in the first place—man, and no longer the earth, nor the influence of climate, nor the determinant conditions of localities.
>
> —Lucien Febvre.[1]

One of the great American technological feats of the early nineteenth century, one that revolutionized the transportation system and soon became a dominant factor in the rapid development of the interior of the country, consisted of a 364-mile canal between Albany and Buffalo, begun in 1817 and completed in 1825. The Erie Canal was a true innovation. Of the American canals preceding it only three were more than two miles long and the longest of these, the Middlesex, was hardly 28 miles in length and in severe financial difficulties by 1816. So new to the United States was the type of work required that the state had to depend upon untrained persons, chiefly lawyers, to plan and supervise construction. Furthermore, the Erie was built largely through unsettled territory, and its economic justification lay not in current traffic but in the expected development of a wilderness when provided with a cheap, long-range transportation line. Hence, George Rogers Taylor refers to the building of the Erie as "an act of faith, the demonstration of a spirit of enterprise by an organized government that has few parallels in world history." [2]

The Canal was not simply another success; it was an enormous, astounding, almost unbelievable success. Throughout the country, the press printed and reprinted astonished accounts of the size of the toll reve-

[1] *A geographical introduction to history*, 236, New York, Knopf, 1925.

[2] See his *The transportation revolution, 1815–1860*, 32–34, New York, Rinehart and Company, 1951.

nues, which were impressive as early as 1823, when large sections of the Canal were open to traffic. Just as impressive were the descriptions of the marvelously rapid development of the affected regions of western New York. Inevitably, the Erie Canal sparked a national canal craze.[3]

The Canal's success vitally affected the rivalry of the major eastern seaboard cities. Up to the 1820's, New York's competitors to the south had confidently relied upon their turnpikes to maintain their position in the western trade.[4] That policy had been successful, for the shortest route to the west led across Pennsylvania, Maryland, and Virginia and the two principal east-west roads favored Philadelphia and Baltimore. It is estimated that in the early 1820's the Pittsburgh Pike carried about 30,000 tons of goods annually, the National Road about 10,000 tons. As a result, Pittsburgh, Cincinnati, and Wheeling became important commercial centers at a time when Buffalo, Cleveland, and Detroit were mere frontier settlements. In this respect, New York City was at a disadvantage during the turnpike era.

The turnpikes' advantages, however, were severely limited. Those tons of goods were overwhelmingly manufactures shipped westward. The bulky agricultural produce of the west continued to use the Mississippi route to New Orleans. Furthermore, the growing use of the steamboat for up-river carriage on the Mississippi and Ohio rivers threatened to deprive the turnpikes of even their westward trade. New Orleans was still a dangerous rival of the eastern seaboard cities.[5]

This situation was transformed by the construction of the Erie Canal. Here was a transportation method far superior both to the turnpike and to the river, with or without steamboats. The Canal immediately took over from the turnpikes a part of the westward trade and, when the immigrants it transported had built up the northern midwest, it carried their agricultural produce back to the east. For the first time, east and west were linked by a direct two-way trade.[6] New York, already in the lead in other fields because of its geographic advantages and superior enterprise, seemed now in a position to dominate the trade of the northern midwest and to extend that domination southward. Her major rivals—Boston, Philadelphia, and Baltimore—were left in the rear facing a most difficult problem. One way out was to imitate the innovation. Bút the Appalachian barrier stood in their way; it granted a relatively water-level route only to New York State.[7]

Nevertheless, the temptation to imitate New York's project was almost irresistible. For if New York's rivals did not get competing lines across their mountains, they would be shut out, it seemed forever, from the western trade. This danger appeared precisely at the time when the center of economic interest was shifting from the ocean to the developing interior, from foreign to internal commerce.[8] A failure to achieve a line to the west, therefore, meant stagnation, even decline; this was the view of the advocates of internal improvement in all the rival cities. As the chapters below will demonstrate, their agitation was imbued with a sense of desperate urgency; to them it was a case of expand or die. On the other hand, the achievement of a line to the west would bring with it enormous prizes; they would participate in the expansion of a continent. And the magnitude of the Erie's financial success seemed to guarantee the success (even though a lesser success) of any canal connecting the Atlantic with the river and canal system of the west. It is not surprising, therefore, that all three of New York's rivals placed their hopes, at least for a time, in that technological monstrosity, a canal over the mountains.

Coincidentally, at the very time that New York's rivals were casting about for some way of overcoming those mountains, the long-run solution to their problem appeared on the horizon. The railroad, still a very primitive thing, was going through a rapid evolution in England during the first quarter of the nineteenth century. In rails, the edge-rail replaced the flat plate, the flange was transferred from rail to wheel, and malleable iron began to replace cast iron. The first locomotive was used in 1804, there was constant improvement in the following two decades, and by the early

---

[3] There were impressive reports, too, of the fast-growing surplus in the New York Canal Fund, but these somewhat exaggerated the situation; much of that surplus came from salt, auction, and other duties which had been earmarked for the Fund. See Segal, Harvey H., Canal cycles, 1834–1861: public construction experience in New York, Pennsylvania and Ohio, 16–17 and 15, table 3, unpublished dissertation, Columbia Univ., 1956.

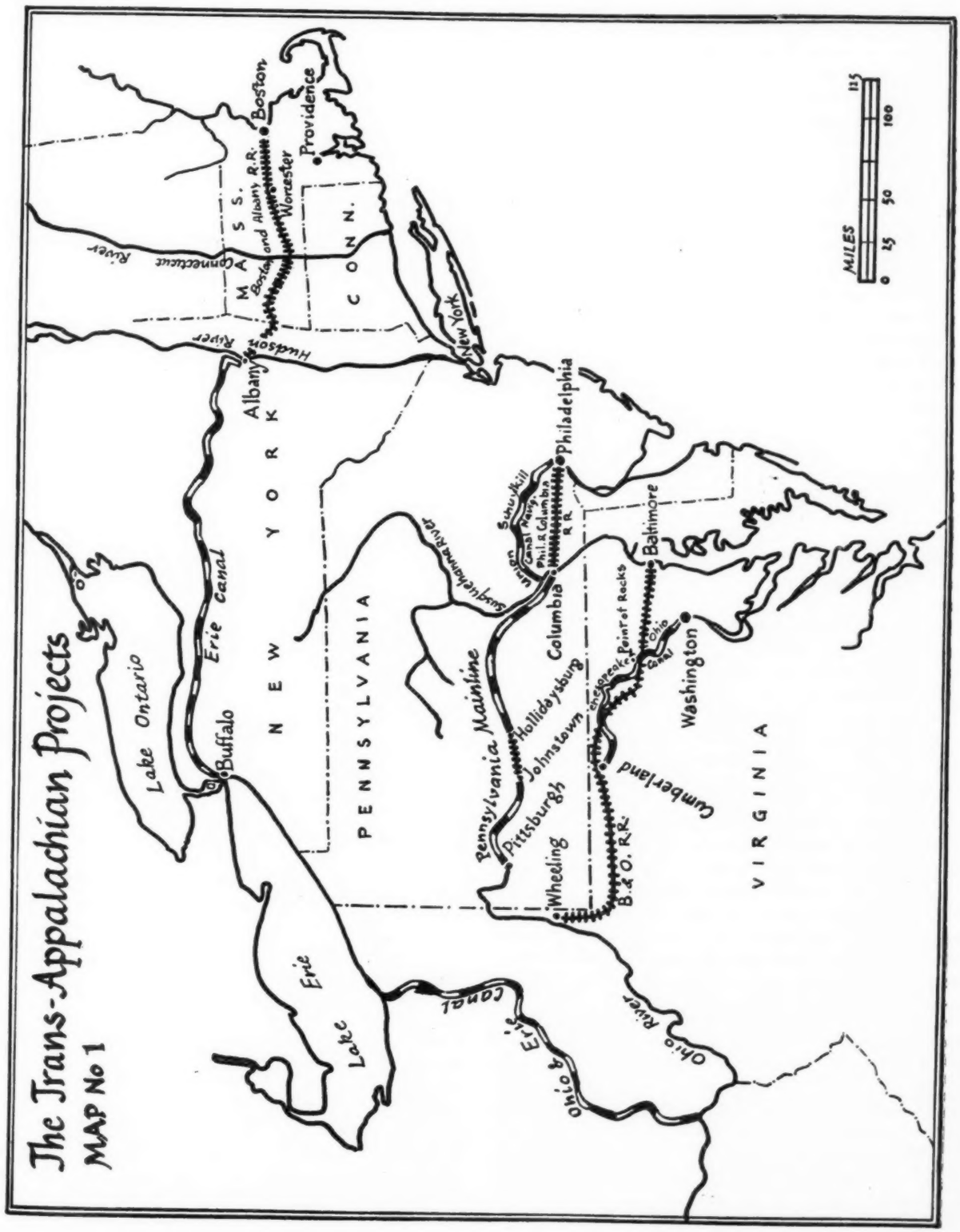
[4] Durrenberger, Joseph Austin, *Turnpikes: a study of the toll road movement in the middle Atlantic states and Maryland,* 126–128, Valdosta, Georgia, 1931.

[5] Sadove, Abraham H., Transportation improvement and the Appalachian barrier: a case study in economic innovation, 138–139, 309, unpublished dissertation, Harvard, 1950; Reiser, Catherine Elizabeth, *Pittsburgh's commercial development, 1800–1850,* 76–77, Harrisburg, Pennsylvania Historical and Museum Commission, 1951; Hunter, Louis C., *Steamboats on the western waters: an economic and technological history,* 17–22, 59, Cambridge, Harvard Univ. Press, 1949.

[6] Sadove, *op. cit.,* 164–166, 177–179; Hunter, *op. cit.,* 482–483.

[7] To geographers, the term "Appalachians" means the entire area from the Piedmont to the Allegheny Plateau, and covers the Blue Ridge, the Appalachian Valley, and the Allegheny Ridges (which include the Berkshires). The principal barriers in the way of canals to the west were in the Allegheny ridges; consequently, I use the term "Alleghenies" and "Appalachians" interchangeably throughout this work. See Emerson, F. V., A geographical interpretation of New York City, *Bull. Amer. Geog. Soc.* **40**: *passim,* 1908.

[8] See Callender, G. S., The early transportation and banking enterprises of the states in relation to the growth of corporations, *Quart. Jour. Economics* **17,** 1903, as reprinted in Lambie, Joseph T., and Richard V. Clemence, editors, *Economic change in America,* 525, Harrisburg, Stackpole Company, 1954.


The Trans-Appalachian Projects
MAP No 1
Lake Ontario
Erie Canal
Buffalo
NEW YORK
Albany
Hudson River
Connecticut River
MASS.
Boston
Providence
Worcester
CONN.
New York
Philadelphia
Baltimore
Susquehanna River
Juniata
Schuylkill Navig.
Phil. & Columbia R.R.
Columbia
Pennsylvania Mainline
Hollidaysburg
Johnstown
Pittsburgh
Wheeling
Chesapeake & Ohio Canal
Point of Rocks
Washington
Cumberland
B. & O. R.R.
PENNSYLVANIA
VIRGINIA
Lake Erie
Erie Canal
Ohio River
MILES
0 15 50 100 115

1820's Stephenson's locomotives were attracting attention all over England. In 1821 a charter was obtained for a horse-drawn freight railroad between Stockton and Darlington, but the amended charter of 1823 gave the road permission to carry passengers (an innovation) and to use locomotives (but stationary engines were used on the steep inclines). The Stockton and Darlington opened on September 27, 1825, and was a resounding success. Its locomotive was able to draw up an easy incline a train weighing eighty tons at ten to fifteen miles per hour.

Thus, by 1825 all the essential elements required to make the railroad the answer to the transportation problems of continental areas had been discovered and tried out on a limited scale in England and Scotland. Furthermore, the rapidity of technological development in this field was a clear indication to many that it was the coming mode of transportation; that soon it would be far superior to the canal because of its flexibility of location, its speed of conveyance, its simpler means of handling grades, and its year-round use. Here was the answer to the Erie Canal, here was the technique that would free New York's rivals from the accidents of nature and would allow them once again to compete for the western trade. This was understood by the railway advocates of the 1820's in all the rival cities; and the expectation was of course fully borne out by events.[9]

But there was another side to the question. The railroad of 1825 was sufficiently developed to indicate its potentialities, but it was not yet adequately tested. The British railroads were all extremely short and almost all were special-purpose lines carrying coal, usually down an incline, from a mine area to a waterway. Only the Surrey Railroad, built in 1804, carried a general line of miscellaneous goods, and it was not a financial success. Even the Stockton and Darlington carried mostly coal and did not develop much of a passenger traffic until the 1830's. But it was not only that the railroad was inadequately tested in Britain; it was nonexistent in the United States before 1826. As many Americans were willing to point out, everything was bigger, better, and deeper in America; the mountains were higher, the frosts more intense, the snows deeper, the spring freshets more violent. Obviously, the railroad had to be tested under American conditions. Since the interregional lines contemplated by the three rival cities required an enormous investment, there was grat danger in proceeding before a series of smaller American railroads had been constructed.

The uncertainty associated with the railroad confronted New York's rivals with a difficult choice. Should they use the tried and tested method of canals in a geographical situation entirely unsuited to that method or should they turn to the new and untried? Should they imitate or innovate? Of course, a third alternative was possible: they could postpone a decision, avoid investment in either railroad or canal, and wait for the railroad to prove itself. But in the meantime New York was monopolizing the western trade. Delay required coolness and great objectivity. The pressure was for immediate action in a deteriorating situation. Consequently, a bitter debate developed in all three cities during 1825 and 1826.[10]

It is of particular interest that each of the rival regions reacted differently. The Pennsylvania improvement movement demanded immediate state construction of a canal to the Ohio and succeeded in obtaining passage of a law authorizing construction of the first segments of such a line in February, 1826. But the great technical difficulty of crossing the mountains by water forced a railroad portage over the summit; then the inadequacies of the existing Union Canal in the east forced construction of another railroad there. Pennsylvania, therefore, ended up with a cumbrous mongrel line requiring three trans-shipments and incapable of competing successfully with the Erie Canal. Baltimore at first also thought of linking its fortunes to a canal by means of a difficult canal feeder to the projected Chesapeake and Ohio Canal. But in February, 1827, a Baltimore merchant group, uninterested in government enterprise, decided upon immediate construction under private auspices of a full railroad line to the Ohio. Massachusetts, however, delayed. There was talk of a canal over the Berkshires, surveys were taken, and in 1826 a canal to the Hudson was recommended by the state commissioners and a nationally known engineer; but by the end of 1826 the leaders of the state's internal improvement movement had realized that the railroad was the answer to Boston's competitive problems. However, they did not call for immediate construction. Only in 1829, when experience and the progress of railroad technique in England had fully proven the advantages of the general-purpose railroad, did they demand state construction of a railroad to the

[9] As early as October 21, 1818, Colonel John Stevens advised President Monroe that "direct communications between Atlantic and Western States so apparent and urgent as to require immediate attention of government; interposition of Allegheny Mountains . . . bars use of canals; transportation of bulky articles limited to turnpike roads; 'should railroads on an improved construction be found upon a trial preferable to canals, it becomes the imperious duty of the general government to adopt and carry into immediate effect a mode of conveyance so facile, cheap and at the same time of such universal application. . . .'" This is the part summary, part quotation from the letter which appears in the Historical Records Survey, New Jersey, *Calendar of the Stevens family papers: preliminary volume,* 73–74, Newark, Hist. Records Survey, 1940.

[10] That the canal *versus* railroad debate was more intense and bitter in this country than in England has been attributed by Earl J. Heydinger to the fact that the two modes of transportation were there separated by half a century, were here almost contemporary. See his, The English influence on American railroads, *Bull. Railway and Locomotive Hist. Soc.* **91**: 41, 1954. From this point of view, it was the fact that the United States was taking over in a short period a long foreign technical heritage that caused the difficulty.

Hudson; and only in 1836, after the failure of intensive efforts to obtain state construction, did a private corporation launch, with great trepidation, a railroad over the Berkshires.[11]

These striking differences in behavior seem completely out of proportion to the small divergencies in the situation of these three closely similar regions. For these were all commercialized coastal areas of the same country; all were subject to the competitive pressure created by the success of the Erie Canal; all were confronted with the problem of crossing a mountain range; all had access to almost identical technical information on canals and railroads; and all made their decisions at almost the same time. Is it possible that extremely small disparities in situation, information, and timing could have produced such large differences in response? I shall try to demonstrate that this is highly improbable. If so, the differences in behavior are to be explained by attitudinal rather than situational factors; by divergencies in the history and traditions of the three regions which produced differences in the attitudes that the decision-making groups brought to the common problem rather than by differences in the problem itself. Since that common problem involved a choice between a tried and untried method and between immediate action and postponement, differences in attitudes toward uncertainty and delay must account for those remarkable differences in behavior. This is the thesis of the following pages.

The thesis requires a good deal of discussion and qualification. Firstly, was the situation actually so similar for all of them? Certainly the mountains were somewhat different for each—in grade, height, hardness and permeability of the soil, and volume of water available. Furthermore, their geographic relation to the west differed. Boston, for example, was off in a corner, with hopes of reaching directly, not the west, but only the Erie Canal at Albany; Baltimore, unlike the others, had to depend on a branch canal to a route that ended at the doorsteps of her competitors, the Potomac cities, if she chose the canal method. Finally, the technical information available to each may have differed in important respects because the crucial decisions were taken at slightly different times. Would railway developments between February, 1826, when Philadelphia decided in favor of the canal, and February, 1827, when Baltimore chose the railroad, explain the differences in the decisions?

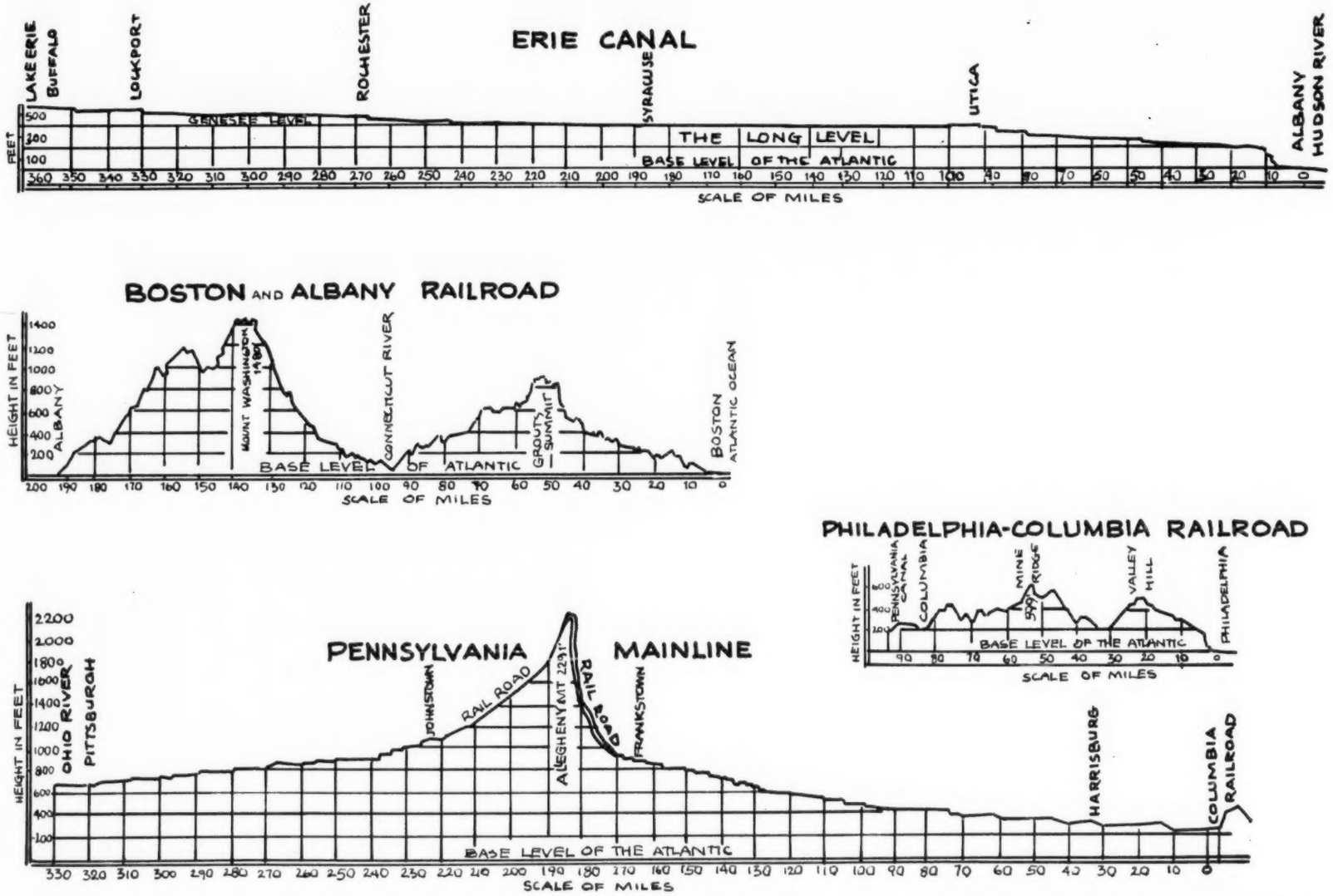
The differences in the physical characteristics of the mountain barrier are, to my mind, the least of the difficulties in the way of the thesis. For all the cities were confronted with the same alternatives. All were assured by competent governmental commissions that a canal over the mountains was technically practicable at varying but not impossible costs, and all had to decide whether the railroad could efficiently overcome a mountain range. The fact that, to take the two extreme cases, the merchants of Baltimore were confronted with a summit height of 2,680 feet while the Massachusetts railroad advocates were confronted with two summits, one of 1,480 feet, the other of approximately 900 feet; that the distance from Boston to the Hudson was approximately 200 miles while the distance from Baltimore to the Ohio was about 380 miles; that of the extremely steep grades confronting all of the cities, one grade was somewhat more steep than another; these are differences, but they fade to insignificance in relation to the overwhelming fact that, in contrast to New York, they all had to climb the Appalachian mountain range.[12] This common factor produced, as we shall see, substantially the same arguments for and against the two modes of transportation in all the cities. Minor differences in these arguments and their possible effects on the decisions will be taken up in the chapters below.

The differences in the various cities' geographic relation to the west constitute a more important limitation upon my attempt to isolate the influence of attitudes. While Baltimore and Pennsylvania could project independent lines to the Ohio River, the great artery of the west of the time, Boston's goal was the Hudson River at the eastern end of the Erie Canal; from that point on the city would use its adversary's route to the west. This gave New York an important advantage: its ships reached the Erie by means of the wide and navigable Hudson River, while Boston's trade would reach the Erie by means of an expensive canal or railroad over the Berkshires. Consequently, while Boston could hope to participate in the trade of the west, it could never hope to replace New York as the great entrepôt of the Atlantic coast.

Boston's situation will be taken up in more detail in Chapter VIII below. For the moment it is important to emphasize that we do not have to assume that any of the rivals of New York had a chance of surpassing New York, nor that they believed in so remote a possibility (despite some euphoric declarations to the contrary). The thesis is that the rivals differed in their ability to take full advantage of the potentialities of their position; that when confronted with an almost identical problem, one city adhered to a by then traditional method entirely unsuited to the situation, another rushed forward with an appropriate but untried method, a third postponed all action until the new method was fully tested elsewhere. That the potential expansion of

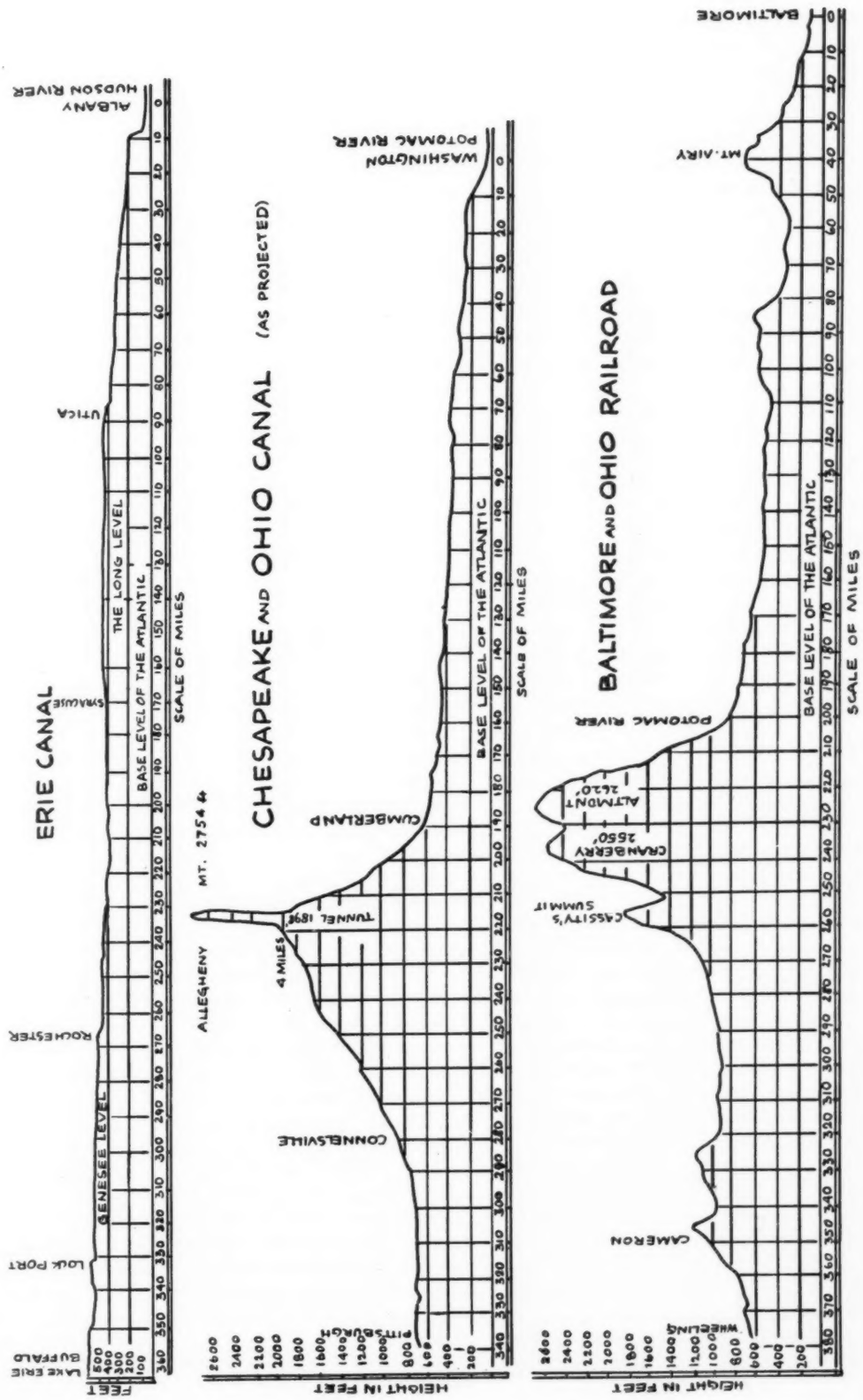
[11] I refer to the decisions of "Massachusetts" and "Pennsylvania" on the one hand, and of "Baltimore" on the other because the former decisions were made by state legislatures under the influence of state-wide movements that were sparked by the respective leading cities. The decision to contruct the Baltimore and Ohio Railroad, however, was made by a group of Baltimore businessmen which involved the state only in regard to subsidies, not in regard to the decision as to mode of transportation and timing.

[12] For a graphic comparison of the routes, see map 1 on p. 7, and figures 1 and 2 on pp. 10–11.



ADAPTED FROM J.L. RINGWALT, DEVELOPMENT OF TRANSPORTATION SYSTEMS IN THE UNITED STATES (PHILADELPHIA, 1888), OPPOSITE P. 72.

FIG. 1. Profiles of the Trans-Appalachian projects.



ADAPTED FROM J.L.RINGWALT, DEVELOPMENT OF TRANSPORTATION SYSTEMS IN THE UNITED STATES (PHILADELPHIA, 1888), OPPOSITE P. 72; AND EDWARD BATES DORSEY, ENGLISH AND AMERICAN RAILROADS COMPARED (2d EDITION, NEW YORK: WILEY AND SONS, 1887), OPPOSITE P.140

FIG. 2. Profiles of the Trans-Appalachian projects.

each city's trade differed is relevant only to the extent that it may have influenced attitudes; a lesser potentiality, for example, might have produced a less inspired, more deliberate attitude.[13] But this effect is not evident in the Massachusetts case. Just as improvement leaders in Pennsylvania and Baltimore envisaged their lines to the Ohio as a link to an expanding continent, leaders in Massachusetts conceived of their line to the Hudson as a link to the continental hinterland of the Erie Canal: to the Great Lakes, to the Ohio canals and the Ohio River, ultimately to the Mississippi and the Gulf of Mexico. And in the eyes of the improvement leaders of all three areas, a failure to build such a line meant stagnation. Thus, the problems, the dangers, and the perceived opportunities were closely similar, if not identical.

Baltimore's relation to the Potomac cities raises a more difficult problem. A canal from Boston or Philadelphia would not have led to a competing coastal city before it headed west; but a canal from Baltimore would have had to go to Georgetown before it went up the Potomac valley. This disadvantage undoubtedly produced in Baltimore a more realistic and sceptical attitude toward the canal method. However, in Chapters VI and VII I shall discuss in detail two considerations that reduce the importance of, though they do not eliminate, this factor. Firstly, before the appearance of the railroad alternative, Baltimore did place its hopes in the canal method, despite the competitive disadvantage. Secondly, the city could have projected a railroad to a point far up the Potomac valley (something impossible with a canal); from that point it could have used the Chesapeake and Ohio Canal as its route to the west without fear of competition from Georgetown. Hence Pennsylvania's mongrel-line method was available to Baltimore; the circumstances of the two cities were similar.

Finally, there are the differences in the timing of the decisions. The leaders of the improvement movement in Pennsylvania rejected the alternative of a full railroad late in 1825, and the legislation for state construction of the first canal segments passed in February, 1826; the leaders of the Massachusetts improvement movement rejected the canal method at the end of 1826; the merchants of Baltimore began their discussion of the railroad alternative in the fall of 1826 and decided to build the railroad in February, 1827. It is important to determine whether the development of technique and the acquisition of further experience in the railroad field between late 1825 and February, 1827, can explain the differences in the decisions. According to the evidence set forth in Chapter III, Pennsylvanians rejected the railroad on the ground that it had never been tested adequately in its general-purpose form; and the railroad was thus tested only in 1830 with the operation of the world's first true general-purpose railroad, the Liverpool and Manchester. Furthermore, the evidence in Chapter VII demonstrates that the experience upon which the Baltimore decision was based was the same as that to which the Pennsylvanians had referred and found inadequate, with but one exception. That exception was the specialized, primitive, three-mile Granite Railroad constructed during 1826 at Quincy, Massachusetts. This railroad did not answer the objections of the Pennsylvanians, for it did not test the general-purpose railroad; indeed it was far more primitive than the current English examples known to them. But as the first American railroad, it did have an impressive demonstration effect. This is the extent to which the difference in the timing of the decisions interferes with the attempt to isolate the effects of the attitudinal factors.

If we may conclude that the differences in the decisions reflected certain differences in the attitudes of the decision-making groups of the three areas, then two questions arise: How may we define these characteristics? And what causes these differences among groups residing in a very similar general environment? This study cannot hope to answer these questions because of two limitations in its scope. Firstly, it does not investigate in detail the decision-making groups; indeed the entire history, traditions, and social and political structure of the three areas lie outside its view. Secondly, it deals with but a single decision in each region; a comparative analysis of many such decisions, both within and outside the field of internal improvements, would be required in order to be able to draw definitive conclusions regarding the nature and causes of those differences in attitudes. Nevertheless, tentative hypotheses are possible, and these may suggest directions for further comparative investigations.

This work deals with decisions of large scope involving the use of new technical means; they therefore involved a good deal of the kind of uncertainty that prevents careful estimates of the probable effects of alternative courses of action. It has often been pointed out that the assumption of rational and prompt decision-making by all economic agents—which means of course identical behavior in relation to the same problem—cannot be applied to such cases. As Joseph Schumpeter has put it:

> . . . the assumption . . . works tolerably well only within the precincts of tried experience and familiar routine. It breaks down as soon as we leave those precincts and allow

[13] For this reason, neither statistical comparisons of the growth of population, trade, and industry of the cities, nor comparisons of the trade and profits of the projects, can test the statements in this work regarding the relative success of each of the rivals of New York. For these statements refer to the extent to which each city took advantage of the potentialities of its situation, while the statistics reflect differences in potentialities as well as in behavior. Chapter II below takes up the trade statistics and profitability of the Pennsylvania Mainline as part of a discussion of the consequences for Pennsylvania of the decision for a canal, not as part of a comparison with the projects of the other cities.

the business community under study to be faced by—not simply new situations, which also occur as soon as external factors unexpectedly intrude but by—new possibilities of business action which are as yet untried and about which the most complete command of routine teaches nothing.[14]

Schumpeter was here writing of the problems of the firm. But in our cases, the decision-makers, except for Baltimore, were larger, more decentralized bodies—legislatures, large internal improvement societies, or less formally organized leaders of state-wide opinion—for whom rational and prompt decision-making under conditions of uncertainty is far more difficult. Furthermore, when the society is democratic and the decision-making unit is political, even larger groups must be convinced of the wisdom of any decision. The private entrepreneur, Schumpeter thought, has a great advantage here. He operates,

> . . . not by convincing people of the desirability of carrying out his plan or by creating confidence in his leading in the manner of a political leader—the only man he has to convince or to impress is the banker who is to finance him—but by buying . . . their services, and then using them as he sees fit . . . he renders a service, the full appreciation of which takes a specialist's knowledge of the case. It is not so easily understood by the public at large. . . .[15]

In the comparison of the Pennsylvania and Baltimore decisions in Chapter VII below we have the opportunity of comparing a decision made, on the one hand, by a large internal improvement movement and a legislature; on the other hand, by a relatively small group willing to invest its own capital. But the situation in Baltimore differed considerably from Schumpeter's description. In these large decisions affecting the long-range economic fates of whole areas, it is impossible for the entrepreneurial group to consider only its "banker." The merchants of Baltimore had to win over a large group of potential investors to the railroad idea and certainly must have felt it important to create a climate favorable to state and city subsidies. In all of our cases, then, great uncertainty as to technical means was combined with the problem of convincing large numbers. A decision on purely rational grounds was therefore ruled out: are other principles of behavior discernible?

The hypothesis here suggested is that the uncertainty associated with these projects must be eliminated by non-rational means before the support of a large sector of the population can be obtained. Chapters III, IV, VI, and VII demonstrate that in the Pennsylvania and Baltimore cases an emotion-charged symbol that seemed to guarantee success exorcised uncertainty from people's minds and produced a mania that made possible a project whose immediate construction had little objective justification. In Baltimore it was the reputation of a wealthy, decisive, and remarkably optimistic merchant group that overcame doubt and hesitation; in Pennsylvania it was the triumphant New York canal policy that was put forward as a guarantee of success to whoever would imitate it. The difference between the Philadelphia and Baltimore decisions, then, reflected a difference in the quality of leadership. The businessmen of Baltimore, by risking their own capital and proceeding on their own, themselves provided the faith that created a railroad mania in Baltimore; but the businessmen of Philadelphia, unwilling to invest and dependent upon a legislature, could obtain action only by appropriating a symbol created by the leadership of another state, a state whose geographical conditions had produced technical means which were entirely inappropriate to the geographical situation of Pennsylvania.

But a mania does not always occur. Massachusetts presents us with a case in which, evidently, both the leadership of the improvement movement and the population were immune to the magic of symbols of great success. In this case, the canal was rejected—the symbol of the Erie Canal did not take hold—and the railroad project was postponed for a decade despite a need for a trans-Appalachian line that was felt at least as urgently in Massachusetts as in the other two areas.

The utter dependence upon a "foreign" symbol in Pennsylvania makes the railroad-canal debate there an extraordinarily interesting one. Fortunately, it is available in the daily newspapers in great detail, for it was public, unlike the debate in Baltimore, and it was long drawn out, unlike the debates in both Baltimore and Massachusetts. Chapter IV describes the peculiarly unreal character of the improvement agitation there. The Pennsylvania leaders managed almost to ignore the mountains in drawing a remarkably crude analogy between Pennsylvania's situation and that of New York, and used the argument, based on the Erie Canal's effects in New York state, that any long-range transportation project through undeveloped regions yields enormous developmental benefits that cannot be measured by toll-gate receipts. The potential applicability of this "economic development argument" to all such large political decisions reinforces Schumpeter's emphasis upon the difficulty of rational behavior in these cases. For, together with the rejection of the measurable profit criterion, the Pennsylvanians were able to reject all the complex technical criteria that should have been involved in the choice between railroad and canal. Since all such projects could succeed, their one criterion became that of experience—this gave them certainty. They, therefore, chose the canal, for the canal had been tested, especially in New York, while the railroad was new and untried. The Pennsylvania case suggests too that an imitation of advances made in other areas that on the surface seems dynamic and enterprising may in reality represent a passive abdication of independent thought, action, and leadership. Both Pennsylvania and Baltimore experienced a mania for improvements.

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[14] *Business cycles* 1: 98, New York, McGraw-Hill, 1939.

[15] *The theory of economic development*, 89, Cambridge, Harvard Univ. Press, 1934.

But in Pennsylvania it was a mania involving imitation while in Baltimore it was a mania for innovation.[16]

Thus, the severe limitation on the scope of this investigation has not prevented some flickering insight into the nature of those divergent attitudes that were produced by the differing histories and traditions of the three regions. But it is of value, I believe, merely to demonstrate the existence of attitudinal differences important enough to have a decisive influence upon decisions that may have determined the long-run economic fates of communities. For it indicates that what is known as "national character"—that little-understood complex of habits and attitudes so important to an understanding of comparative economic development but so difficult to define and investigate—can be investigated on a relatively small scale, among communities which are otherwise quite similar in economic function, in social structure, and in general environment. This may be especially true of the early nineteenth century. For this was the period of the "parochial point of view," when the scope of businessmen's decisions was local or regional and when they could not easily change the locus of their activities. Their fortunes were largely tied to their city's economic development, just as later they were to be tied to their country's development.[17] This period of "municipal mercantilism," therefore, provides us with an opportunity to study on a small scale that which later can only be studied on the large.[18] If our aim is to isolate the casual factors in economic development by means of the comparative method, then the comparison of similar cities and regions in one country during this early period may yield results impossible to obtain in national comparisons, where the scale is so formidable and the differences of all kinds are so great. The present study presents some preliminary evidence for this belief.

[16] On the general use of the "economic development argument" in the internal improvement movement and the contemporary inability to develop a rational criterion for the selection of projects for government support, see Goodrich, Carter, American development policy: the case of internal improvements, *Jour. Econ. Hist.* **16**: 455, 1956.

[17] In *The American railroad network, 1861–1890,* by George Rogers Taylor and Irene D. Neu, Cambridge, Harvard Univ. Press, 1956, these changes in the scope of businessmen's decisions are related to the development of a national, standard-gauged railroad system out of the deliberately divided regional systems of the pre-Civil-War period. See esp. pp. 3–7.

[18] The term "municipal mercantilism" has been suggested by James P. Cairns in his: Response of New Orleans to diversion of trade from the Mississippi river, 1845–1860, 144–145, unpublished master's essay, Columbia Univ., 1950.

II. PRELUDE TO A CRUCIAL DECISION

THE CONSEQUENCES OF THE DECISION

In February of 1825, years of intensive internal improvement agitation in Pennsylvania culminated in a recommendation by a majority of the state's Canal Commissioners for state construction of a great "mainline" canal from Philadelphia to Pittsburgh. By this means, Philadelphia would be provided with a cheap, all-water transportation line with which it could prevent the threatened New York monopoly of the western trade. In the following month, there appeared in Philadelphia an anonymous pamphlet which advocated construction of a full railroad line to the west and warned of the inevitable failure of any attempt to build a canal over a mountain range. The pamphlet's proposals were read widely and avidly; the result was an extraordinary public discussion. A violent, emotional debate on a highly technical issue was carried on throughout 1825 in newspapers and pamphlets between the advocates of the railroad and the defenders of the canal.

The canal advocates won; a bill for construction of segments of the mainline canal became law in February, 1826. During the debate, however, the leaders of the improvement movement had come to realize that a full canal was out of the question, that a railroad portage in the mountain section would be required. In the years after the act was passed it also became apparent that the narrow Union Canal between Philadelphia and the terminus of the mainline at the Susquehanna would have to be replaced, not by a broader and more direct canal as had been supposed during the debate, but by a railroad. Consequently, the mainline, as completed in 1834, consisted of a railroad from Philadelphia to the Susquehanna, a canal from the Susquehanna to Hollidaysburg at the eastern end of the mountain sector, a "portage railroad" over the mountains to Johnstown, and a canal the rest of the way to Pittsburgh. The portage railroad contained five inclined planes on each side of the summit; at the head of each plane were two stationary engines. Between the planes were level stretches on which locomotives were used. The great disadvantages of so broken a line were realized almost immediately. The movement for a continuous railroad began only four years after completion of the mainline and culminated in the building of an entirely new line by the Pennsylvania Railroad Company.

These were the events that followed the 1826 decision to adhere as closely as possible to the canal method. They raise some interesting questions: Was not the decision a serious error? Would it not have been preferable to omit the canal-sections phase and to have completed the full railroad in the 1830's instead of the 1850's? Finally, if the decision was an error, how important were its economic consquences for Philadelphia? These are the questions I shall try to answer before proceeding to an analysis of the causes of the 1826 decision.

Two eminent historians have suggested the answers. Firstly, there was a failure: the mainline "never became a strong competitor of the Erie."[1] Secondly, there was an alternative: "Those fourteen million dollars might have been spent to excellent advantage on an all-rail route, which might have done wonders, in the formative years, in diverting the western trade from New York."[2] Let us take the failure first.

Success and failure are of course relative, depending on the criteria; hence it will be best to measure the record of the mainline against the expectations that led to its construction. The state improvement movement had claimed, firstly, that the mainline would earn huge profits; secondly, that it would capture the trade of the west; thirdly, that it would develop the population, agriculture, and industry of the entire state.[3] These will be our criteria. A fourth claim, that the mainline would develop a trade on the scale of that of the Erie, was important in mainline propaganda during 1825 but should not be used as a criterion of the project's success. For there can be no doubt that any Pennsylvania line—railroad, mongrel, or canal—would have failed in such an attempt. The existence of one thousand miles of navigable waterway at the western end of the Erie guaranteed that its success would not be duplicated in the 1830's and 1840's.[4] A failure in this sense was inevitable; it was determined by geography.[5]

By the financial criterion, the failure of the mainline is all too clear. Its original cost was $12.1 million; its total cost through 1857 was $16.5 million; and the excess of revenues over current expenditures through 1857 came to $6.7 million.[6] Mainline advocates, however, did not consider the financial criterion to be the important one. Although they claimed that they expected a great financial success, they were careful to add that a financial failure could still be eminently worthwhile to the state. We turn, therefore, to the second criterion: did the project capture any large part of the trade of the west?

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[1] Taylor, *Transportation revolution*, 44.

[2] Albion, Robert G., *The rise of New York Port*, 378, New York, Scribners, 1939. The original cost is put at $12,106,788 in Bishop, Avard L., The state works of Pennsylvania, *Trans. Amer. Acad. of Arts and Sciences* 13: 238–239, 1907.

[3] These expectations will be discussed more fully below.

[4] Dean, William H., Jr., The theory of geographic location of economic activities with special reference to historical change, 195, unpublished dissertation, Harvard Univ., 1938.

[5] Bishop, *op. cit.*, 153 makes this statement.

[6] *Ibid.*, 280. Bishop gives the year-by-year figures for each section of the main line on pp. 278–280. Segal, *op. cit.*, 214, gives net revenues as per cent of cost, year by year.

It is true that the mainline, which was soon connected by canal to the Ohio Canal, offered an alternative to the Erie for shippers over a wide area. But it was soon found that the advantage in distance gained by going through Pennsylvania rather than through the Great Lakes and New York was more than offset by the broken character of the transportation line.[7] A Philadelphia businessman, writing in 1859 on the general lack of Philadelphia enterprise, quoted the city's import and export figures in the 1830's to prove that the effect of the mainline was imperceptible. Charging that "Its capacity for competition in this trade was wholly miscalculated . . . ," he attributed its failure to the high costs and extreme inconvenience suffered by shippers of bulky products from the west. Only a milder climate that allowed a longer shipping season than on the Erie and the local trade along its route saved it, he thought, from total abandonment.[8] In 1839 delays and high tolls on the mainline convinced shippers and millers in western Pennsylvania that it was cheaper to send flour down the Mississippi to New Orleans, then by ship to Philadelphia, than to use the mainline.[9]

The trade statistics confirm these impressions. Through traffic on the mainline, as measured by the traffic over the portage railroad, amounted to an estimated 29,740 tons westbound and 15,439 tons eastbound in 1836 and reached a peak of 83,972 tons in both directions in 1845.[10] This westbound freight was considerable—it was comparable to that of the Erie in those years—and a fairly large number of passengers were carried in both directions. But the west's heavy agricultural goods could not bear the cost of several transfers between railroad and canal. Very little of the estimated 100,000 tons of freight that was shipped annually to New Orleans from the Ohio Valley in the early 1820's was ever diverted to the mainline. In this lay its failure. While New York's Erie Canal—Great Lakes—Ohio canals route took over both the import and the export trade of the northern part of the old west, the southern part continued to use the Ohio and Mississippi rivers for bulk commodities and, to a great extent, the turnpikes for more valuable goods.[11]

However, there is the third criterion: did the mainline help to develop the economy of the state? Whereas its failure to divert the trade of the west should be measured by the through traffic, which was small, its benefits for the state should be measured by the total traffic, which was much larger.[12] That total traffic reflected the industrial development of Pennsylvania. The mainline received large quantities of coal and raw iron from the Union Canal, from the canals along the north and west branches of the Susquehanna, from the valley of the Juniata, and from the huge bituminous coal fields west of Hollidaysburg. A good part of the iron was sent to Pittsburgh for manufacture and then transported east again; and quantities of bituminous coal were shipped eastward to the seaboard cities. In addition, large amounts of salt manufactured in the valleys of the Conemaugh and the Kiskiminetas were shipped to market on the mainline.[13] To the Pittsburgh iron interests, the mainline was a lifesaver. A local improvement would have been adequate to bring the needed supplies to the city, but the undertaking would have been far too costly for them.[14] The mainline, then, by assembling materials from districts formerly too far apart to cooperate in the manufacturing process, materially aided the industrial development of Pennsylvania.[15]

However, even when this is taken into account, the mainline was not an unmixed blessing. There can be no doubt that the huge amounts spent on a line that failed to meet the financial and commercial expectations

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[7] See Bishop, *op. cit.*, 245–246.

[8] Baker, G. W., *A review of the relative commercial progress of the cities of New York and Philadelphia, 22–23*, Philadelphia, 1859. There was good reason for dissatisfaction with the state of Philadelphia's import and export trade. In 1826, the year in which construction of the mainline was begun, the value of imports was $13 million; in 1835, the year following completion of the mainline, the figure was $12 million; in 1840, it was $8 million; in 1845, $8 million; and in 1850, $12 million. Exports did no better: in 1826, $8 million; in 1835, $3 million; in 1840, $6 million; in 1845, $3 million; in 1850, $4 million. In the United States as a whole, on the other hand, both imports and exports more than doubled between 1826 and 1850. See Albion, *op. cit.*, 390–391.

[9] Burgess, George H., and Miles C. Kennedy, *Centennial history of the Pennsylvania Railroad Company, 1846–1946*, 25 Philadelphia, Pennsylvania Railroad Company, 1949.

[10] Bishop, *op. cit.*, 248–249. Traffic over the trunk turnpikes from the east to Pittsburgh between 1818 and 1824 has been estimated at 30,000 tons annually, an amount that continued to grow even after the completion of the Pennsylvania mainline. Through traffic on the Erie Canal in 1837 amounted to 38,893 tons westbound, 54,219 tons eastbound; in 1845, 42,415 tons westbound, 304,551 tons eastbound. See Sadove, *op. cit.*, 138; Reiser, *op. cit.*, 77.

[11] Sadove, *op. cit.*, 138, 154–155, 356–357; Hunter, *op. cit.*, 483–484; Johnson, Emory R., *et al.*, *History of domestic and foreign commerce of the United States* **1**: 236–237, Washington, Carnegie Institution, 1915; Parkins, A. E., The development of transportation in Pennsylvania, *Bull. Geog. Soc. Philadelphia* **14**: 159; Andrews, Israel D., *Report . . . on the trade and commerce of the British North American colonies, and upon the trade of the Great Lakes and rivers . . .*, 262, Sen. Executive Doc. 112, 32nd Congr., 1st sess., Washington, 1854. Sadove uses the western division of the National Road as the approximate dividing line between the northern west, which sent its exports via the Great Lakes to New York City, and the southern west, which continued to use the Mississippi route.

[12] The only tonnage figures available include the trade of the branches of the Pennsylvania State Works and the local trade entering Philadelphia from the Susquehanna and the Delaware. For the figures see Sadove, *op. cit.*, 152, who took them from Chevalier, Michel, *Histoire et description de voies de communication aux Etats Unis, Paris*, 1840–1841.

[13] Strong, Henry K., Main Line of States Works of Pennsylvania, *The Merchants' Magazine*, ed. by Freeman Hunt, **13**: 127–138, 1845.

[14] Reiser, *op. cit.*, 106.

[15] Clark, Victor S., *History of manufactures in the United States* **1**: 349–350, New York, McGraw-Hill, 1949.

of its sponsors delayed for years the construction of a full railroad across Pennsylvania.[16] The importance of that delay can be gauged from the accomplishments of the trunk railroads in the 1850's. As long as rivers and canals were the primary carriers of inland transport, New Orleans shared dominance with New York in the western trade. It was the trans-Allegheny railroad lines that finally brought the produce of the southern west directly to the eastern seaboard.[17] The Pennsylvania Railroad was able to participate in this development. Like the mainline, its principal traffic was determined by the industrial development of Pennsylvania, but in 1860 it transported 176,007 tons from Pittsburgh to Philadelphia, half of which consisted of livestock, flour, and grain.[18] Hence it was only with the completion of the Pennsylvania Railroad that the state, "destined by geographic conditions to a land traffic," at last found a method of transportation adapted to its commercial as well as its industrial needs.[19] But that railroad was completed only in 1852, too late to divert a good portion of the trade that had centered on New York for a quarter of a century. Furthermore, the opportunity to utilize the advantages of the railroad against New York's canal was lost; by 1852 the Erie Railroad, the roads that were to combine into the New York Central, and the Hudson River Railroad were all in operation, and connecting lines were being extended to Chicago.[20]

Was the mainline decision avoidable? Could the advantages of the railroad have been realized early enough to affect that decision? Those advantages were certainly generally realized during the period of construction of the mainline. By the time of the mainline's completion in 1834, the Baltimore and Ohio had reached a point on the Potomac opposite Harper's Ferry, the New York and Erie Railroad had been incorporated and a start had been made on the series of railroads paralleling the Erie Canal. "New Yorkers had already found that a waterway which was out of operation nearly half of every year could not provide for the transportation needs of the rapidly growing commerce of the country." The obsolescence of the mainline was clear even before the work was completed.[21]

Could the advantages of the railroad have been understood even before the 1830's? The succeeding chapters of this paper will show not only that those advantages were clearly understood in Baltimore and Boston in 1826, but that the characteristics of the railroad, those that made its great accomplishments possible, were known to Pennsylvania railroad advocates in 1825: its all-weather operations compared to the seasonal freezing and drought to which the Pennsylvania canals were subject; the safe, unobstructed passage of freight compared to the rapids on the Mississippi that caused spoilage and transshipment; finally, the incomparable speed of the railroad which allowed the carriage of perishables and saved so much in working capital.[22]

Granting that the long-run advantages of the railroad and their consequences were foreseen in 1825, another more hypothetical question arises. Could an earlier railroad have done what the railroad of the 1850's accomplished? If the mainline movement had taken the advice of the railroad party and postponed the entire railroad-canal issue in order to await the outcome of the current railroad experiments in England, construction of a full railroad in Pennsylvania would probably have begun after the definitive and dramatic Rainhill Trials on the Liverpool and Manchester Railroad in October, 1829, the trials that proved the practicability of the locomotive on the general-purpose railroad.[23] In that case, the Pennsylvania railroad would have been built in the early 1830's. The question then is, was railroad technology sufficiently advanced by the early 1830's to have produced a railroad that would have avoided the failure of the mainline?

The answer depends in part on the precise reasons for the mainline's failure. Two factors are held responsible: on the one hand, the need for transshipments; on the other hand, the small capacity and great delays produced by the inclined planes and stationary engines of the portage railroad. A railroad line built in the 1830's would have eliminated the transshipments; it could not have eliminated the inclined planes. If it

[16] See Baker, *op. cit.*, 34; and the letter from S. Moylan Fox in Philadelphia Select and Common Councils, *Reports of the joint special committee . . . relative to the Pennsylvania Railroad Company*, 20, Philadelphia, 1846.

[17] Johnson, *op. cit.* **1**: 238–239; Dean, *op. cit.*, 211–213.

[18] Johnson, *op. cit.* **1**: 238.

[19] Parkins, *op. cit.* **15**: 8–9. For the effects of the Pennsylvania Railroad on Philadelphia's rivalry with Baltimore, see Livingood, James Weston, *The Philadelphia-Baltimore trade rivalry, 1780–1860*, 151, Harrisburg, Pennsylvania Historical and Museum Commission, 1947.

[20] It should be noted, however, that the railroads west of Albany were not yet physically connected to the Hudson River Railroad. See Albion, *op. cit.*, 384–385; the same author's, New York Port and its disappointed rivals, 1815–1860, *Jour. Business and Economic Hist.* **3**: 617, 1931; Parkins, *op. cit.*, **15**: 12; Isard, Walter, The economic dynamics of transport technology, 52, unpublished dissertation, Harvard, 1943. Isard speculates that if the trans-Allegheny railroad had appeared earlier, "the economic ascendancy of New York City would have been less marked; perhaps her industrial and commercial supremacy would not have been achieved at all." However, New York had other advantages.

[21] Burgess and Kennedy, *op. cit.*, 11–12.

[22] See Stephens, George Ware, Some aspects of early intersectional rivalry for the commerce of the upper Mississippi valley, *Washington Univ. Studies, Humanistic Series* **10**: 281, 285–296, 1923, for a discussion of the factors responsible for the changeover from the triangular trade through New Orleans to the direct east-west trade. He lists, in addition to the abovementioned factors, the use of eastern credit and the failure of the south to develop industry.

[23] Jackman, W. T., *The development of transportation in modern England* **2**: 524–527, Cambridge, at the University Press, 1916.

was the inclined-plane method that caused the failure of the mainline, a railroad built in the 1830's could not have succeeded.

There is abundant evidence, however, for considering the transshipments to be the principal and probably the decisive disadvantage. As a Philadelphian put it in 1852,

> . . . the chain that was to bind Philadelphia with the west was . . . severed, disjointed, fragmentary. It was an amphibious connection of land and water, consisting of two railways separated by a canal, and of two canals separated by a railway, happily elucidating the defects peculiar to both methods of transit, with the advantages of neither.[24]

So prominent were its disadvantages of delay and expense that it served as a warning against the further building of mongrel lines.[25]

The expense of transshipment was undoubtedly very heavy. Every one of the transportation companies that handled the freight, no matter how small it was, had to have available both cars and boats and had to maintain five sets of depots and agents, located at Philadelphia, Columbia, Hollidaysburg, Johnstown, and Pittsburgh. A businessman with extensive experience in both Pennsylvania and New York testified that the 399 miles by mainline between Philadelphia and Pittsburgh was equivalent in expense to 600 miles of canal, and estimated that maintaining a daily line of freight boats on the mainline "involved a dead loss of about $15,000 when compared with the Erie Canal. . . ." [26] An engineer testified that the transshipments caused frequent delays and a high incidence of lost and damaged goods. "The machinery is too complicated for an extensive trade." [27]

The disadvantage was never effectively overcome, despite intensive and ingenious efforts. Canal boats were built in sections capable of being carried on trucks over the portage railway, and cars were built which could be lifted off the wheels and transferred to specially constructed canal boats. But the wear and tear on boats and cars and the dead weight added were serious drawbacks.[28]

There is room for some difference of opinion as to whether the inclined planes on the portage railway were a serious handicap. One study refers to the portage as "the weak link in the whole system of east and west traffic lanes, in the opinion of all";[29] and another reports that "to avoid the delay and expenses attending the use of the inclines, Philadelphia merchants soon found it to their interest to pay the freight on their goods to New York, and then ship to the West over the Erie Canal." [30] However, it is not clear whether these accounts distinguished between two causes of delay and expense that were linked to the portage railroad. On the one hand, there was the expense of operation and maintenance and the delay of freight and passengers caused by the ten inclined planes and the use of stationary engines. On the other hand, there was the expense and delay caused by the need for transshipment at each end of the portage.

Probably the most accurate testimony on this question can be found in the 1846 *Reports* of the Joint Special Committee of the Philadelphia Select and Common Councils, appointed to investigate the desirability of a Philadelphia subscription to the projected Pennsylvania Railroad. The Committee solicited letters from various merchant houses and engineers on the faults of the mainline system. According to the testimony, the serious obstructions and expense were caused, not by the planes and stationary engines, but by the detentions at the points of transshipment.[31] The later accounts of severe criticisms of the use of inclined planes reflected, at least in part, the obsolescence of that method by the 1850's; they are no measure of the role of the inclined planes in the competitive failure of the mainline during the late 1830's.[32]

Still another consideration must be taken into account in gauging the probable effects of each of the choices available to Pennsylvania in the late 1820's. No matter what its immediate success, and despite the constant experimentation and reconstruction required by the railroads of the 1830's, a full railroad would have allowed Philadelphia to take immediate advantage of advances in railroad technology. The transition to a modern efficient line would have been incomparably faster and cheaper.

The evidence is clear. Pennsylvania had a real choice of methods available to her and a mistake was made. That this mistake had serious results can hardly be doubted. For a decade, Philadelphia suffered the consequences of the realignment of trade brought about by the interregional railroads without receiving any of the benefits. In 1841 the first through railroad over the Appalachians connected Boston to Albany. Boston's merchants, previously forced to sell New England's

[24] Tyson, Job R., *Letters on the resources and commerce of Philadelphia . . .*, 14, Philadelphia, 1852.

[25] See Bishop, *op. cit.*, 246–248; Andrews, *op. cit.*, 264; *Register of Pennsylvania* **7**: 218–219, 1831; Livingood, *op. cit.*, 132; *Niles' Weekly Register* **60**: 188, 1841.

[26] Pennsylvania House of Representatives, *Journal* **3**: 514, 1838–1839, quoted in Bishop, *op. cit.*, 247n.

[27] *Ibid.*, 248n.

[28] Roberts, Solomon W., *Reminiscences of the first railroad over the Allegheny mountains*, 76, Philadelphia, 1879. See also, Burgess and Kennedy, *op. cit.*, 20–21.

[29] Parkins, *op. cit.* **14**: 164. See also, Burgess and Kennedy, *op. cit.*, 21.

[30] Sadove, *op. cit.*, 152, quoting Cleveland, Frederick A., and Fred Wilbur Powell, *Railroad promotion and capitalization in the United States*, 102, New York, Longmans, Green, 1909.

[31] See the letters from Edward Miller and S. Moylan Fox, engineers, in Philadelphia Select and Common Councils, *Reports of the joint special committee . . . relative to the Pennsylvania Railroad Company*, 19–20.

[32] For such criticisms see Andrews, *op. cit.*, 264: ". . . inclined planes are now regarded as incompatible with the profitable operation of a railroad . . ."; see also, *American Railroad Jour.* **25**: 67, 1852.

manufactured goods and to receive its food products through the merchants of New York and Philadelphia, quickly established direct connections with the merchants of the west. Philadelphia lost one of its best markets for breadstuffs and a large part of the trade in New England dry goods and other manufactures that had formerly passed through the city to the west.[33] Furthermore there were cumulative effects. One writer refers to the "gloom which pervaded the commercial ranks of society" in Philadelphia when the failure of the mainline to compete with the Erie was followed by severe loses in the China trade: "some of our most astute and enterprising merchants removed to New York." [34]

Clearly the following pages deal with a decision crucial to the long-run economic fate of Philadelphia. We begin with the origins of the mainline project and and of the railroad idea in Pennsylvania.

PRELUDE TO THE DEBATE, 1786–1825

The idea of a canal over the mountains of Pennsylvania originated about the same time as the first proposals for the Erie, the Chesapeake and Ohio, and the Boston-to-Hudson River canal projects, that is, in the late eighteenth century. Mathew Carey suggested a canal connection between the Delaware and the Ohio rivers in an article published in September, 1786; in 1791, when Baltimore was securing a part of the Pittsburgh trade by means of the Cumberland road, the "Pennsylvania Society for Promoting the Improvement of Roads and Inland Navigation" reported favorably on the feasibility of a canal from Philadelphia to Pittsburgh; and in the same year Albert Gallatin proposed a road-and-canal project in the state legislature. But, as in the case of the Chesapeake and Ohio and Boston-to-Hudson projects, the canal idea was not seriously discussed until New York began the construction of her Erie Canal.[35]

The directing force behind the movement for a modern transportation line between Philadelphia and Pittsburgh was the Pennsylvania Society for the Promotion of Internal Improvement in the Commonwealth (hereinafter referred to as "the Society" or "the Pennsylvania Society"). It was fathered by Mathew Carey, the well-known Philadelphia publisher and propagandist, in October, 1824, when he distributed circulars outlining a plan for a small organization that would finance the dissemination of information on roads, canals, bridges, railways, and steam engines. Formal organization took place on December 14, with forty-eight of the leading citizens of Philadelphia as charter members. Carey was elected vice-president and chairman of the Acting Committee.[36] The size of the Society remanied small: in a January, 1826, report, the Acting Committee reported a membership of forty-four.[37]

The stated purposes of the Society were, first, to disseminate knowledge throughout the state regarding the transportation problem and the urgent need for improvements, with the purpose of forcing legislative action; second, to collect information on transportation possessed by other states and foreign countries. Meetings were held every two months. The Acting Committee, elected each year, directed the day-to-day educational work of the Society.[38] As one of its members put it, the Society was organized in response to the sad contrast between New York's great advance and Pennsylvania's indecisiveness and delay. There were many friends of internal improvement in Pennsylvania, "but they had no interchange of opinion, no concerted and arranged plan of measures and operations." [39]

That concerted plan was supplied by a small, geographically-concentrated group. The Society's membership in 1825 consisted mainly of Philadelphia businessmen and was severely limited by the substantial initiation fee of $100. The fee was justified as necessary to meet large anticipated expenses; it was supplemented, however, by donations from coal companies and "liberal individuals." Annual dues were $10 and total receipts by January, 1826, were $5,540.[40]

The January, 1826, report of the Society's Acting Committee complained, evidently for the first time, of the inadequacy of annual revenues—with a membership of forty-four only $440 would be received in the coming year—and suggested a reduction of the initiation fee. That high fee, the Committee remarked, had kept

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[33] Johnson, *op. cit.* **1**: 237.

[34] Tyson, Job R., *Letters on the resources and commerce of Philadelphia . . .*, 14, Philadelphia, 1852.

[35] Rowe, Kenneth Wyer, *Mathew Carey: a study in American economic development*, in *Johns Hopkins Univ. Stud. in Hist. and Polit. Science* **51**: 18, 1933; Pomerantz, Sidney I., *New York: an American city, 1783–1801*, 161–162, New York, Columbia University Press, 1938; Parkins, *op. cit.*, 104; Walters, Raymond Jr., *Albert Gallatin*, 47, New York, Macmillan, 1957; Emerson, *op. cit.* **40**: 609, 1908.

[36] Carey, Mathew, Diary, unpublished ms. in the University of Pennsylvania library, covering the period between December 15, 1822, and June 16, 1826, notations under October 19 and November 30, 1824; Rowe, *op. cit.*, 89; Bishop, *op. cit.*, 174–175. The list of charter members appears in Carey, Mathew, *Brief view of the system of internal improvement of the state of Pennsylvania . . .*, 13, Philadelphia, 1831.

[37] Pennsylvania Society . . . Acting Committee, *First Annual Report . . .*, 25, Philadelphia, 1826, dated January 4, 1826.

[38] *Poulson's American Daily Advertiser*, Philadelphia, March 24, 1825; Bishop, *op. cit.*, 175.

[39] Strickland, William, *Reports on canals, railways, roads, and other subjects, made to the "Pennsylvania Society . . ."* preface, Philadelphia, 1826. The preface is unsigned and not by Strickland.

[40] Dunbar, Seymour, *A history of travel in America*, **3**: 897, Indianapolis, Bobbs-Merrill, 1915; Hartz, Louis, *Economic policy and democratic thought: Pennsylvania, 1776–1860*, 131, Cambridge, Harvard Univ. Fress, 1948; Carey, *Brief view*, 13; Pennsylvania Society . . . Acting Committee, *Address*, 3, dated February 1, 1826, signed by Mathew Carey; Pennsylvania Society . . . Acting Committee, *First Annual Report . . .*, 7.

out many friends of internal improvement and had been justified only by the immediate necessity of raising funds for Strickland's mission to Europe.[41] In February, 1826—the month in which the crucial mainline decision was made—Carey announced the reduction of the initiation fee to $20 and of the annual dues to $5. Acknowledging that the high fee had produced the serious disadvantage of debarring the Society of the advice of "many of our best and most useful citizens," he hoped that the reduction would "completely remove the only valid objection ever offered against the association. . . ." [42]

The importance of the Society can best be judged from its activities. By March of 1825 it had published eight technical papers on turnpikes, canals, and railways, in editions of one thousand copies each. Its essays were reprinted in newspapers throughout the state. Committees were set up in every county to discuss the improvement issue and to memorialize the legislature. Circulars were distributed over and over again in favor of a modern transportation line between Philadelphia, Pittsburgh, and the Great Lakes. A great internal improvement convention at Harrisburg was organized with the help of the Society. A prominent Philadelphia architect and engineer, William Strickland, was commissioned to investigate recent European improvements. Strickland and his assistant, Samuel Kneass, left for England on March 20, 1825; beginning in August, his mailed reports were distributed by the Society in pamphlets and broadsides which were reprinted in the press throughout the state.[43] Clearly, the improvement forces of the state did not lack leadership during the railway-canal debate of 1825. They were led by a centralized group of relatively wealthy men with unequalled access to the best technical data available, a group obviously able to give the movement direction and focus.

The Society was organized at a time of national canal agitation. The Erie Canal, partially open, was already demonstrating its tremendous potentialities. Further south, the agitation for a Potomac canal to the Ohio was achieving its first results—by February, 1823, surveys to Cumberland had been completed, a Potomac Canal Company had been organized and had received a provisional charter from Virginia, and a congressional committee had recommended to the attention of the House the impressive possibilities inherent in such a line. As a result, the Pennsylvania legislature, formerly passive, suddenly acted with great dispatch. A mainline bill that had been pigeonholed since February of 1823 was reported out favorably in December in recognition, as the House committee put it, of the urgent need to keep pace with New York and Baltimore. The bill, signed into law on March 27, 1824, called for the appointment by the governor of a three-member Board of Canal Commissioners to explore three possible routes for a Philadelphia to Pittsburgh canal.[44]

The years of delay were now succeeded by months of extreme haste. The Board was appointed within four days of the signing of the bill and was required to report to the governor before the next session of the legislature in December, giving it very little time to make the required surveys. Unable to obtain a competent engineer, the Board began its work without one. Nevertheless, a majority report was issued in February, 1825, and signed by two of the three commissioners, Jacob Holgate and James Clarke. It announced the "perfect practicability" of a continuous canal from Philadelphia to Pittsburgh, providing that a 4½-mile tunnel be driven under the summit of the Alleghenies. The commissioners recommended the route along the Susquehanna and Juniata rivers in the east, along the Conemaugh and Allegheny rivers in the west; they estimated the cost of construction from Middletown on the Susquehanna to Pittsburgh at $3 million (including $480,000 for the summit tunnel); and they thought it could be completed in six years.

The commissioners suggested that the mainline at first use the Union Canal and the Schuylkill Navigation as the link from the Susquehanna to Philadelphia, but stressed that this could be but a temporary expedient, for the canal was circuitous—the country was hilly and short of water—and its narrow locks could never handle "the whole commerce of the west" when it came streaming through the mainline and combined with the river trade at the Susquehanna. A larger, more direct canal would have to be built, but as their surveys in this area were even more sketchy than elsewhere, they did not estimate the cost. They did estimate, however, that it would require a lockage of 741 feet in about 125 miles. On the western end, an eventual extension to Lake Erie was recommended, for then "we can take the cream off the lake trade before the icy fetters of winter are loosened from the New York canal."

The tunnel would be 754 feet below the summit of

[41] Pennsylvania Society . . . Acting Committee, *First Annual Report*, 25–26.

[42] Pennsylvania Society . . . Acting Committee, *Address*, 3. An editorial in *U. S. Gazette* of February 23, 1825 refers to criticisms of the exclusiveness of the Society. Carey's biographer attributes the fee reduction to the fact that the Society's treasury in January of 1826 contained insufficient funds to publish Strickland's reports. See Rowe, *op. cit.*, 92.

[43] Pennsylvania Society . . . Acting Committee, *To the citizens of the commonwealth of Pennsylvania*, reprinted in *U. S. Gazette*, March 22, 1825; same author, *First Annual Report*, 10–14; same author, *Address* 1–2; Bishop, *op. cit.*, 178–179; Shelling, Richard I., Philadelphia and the agitation in 1825 for the Pennsylvania Canal, *Pennsylvania Mag. of Hist. and Biog.* **62**: 178–184, 1938; Hartz, *op. cit.*, 132; Rowe, *op. cit.*, 91; Gilchrist, Agnes Addison, *William Strickland, Architect and Engineer, 1788–1854*, 6, Philadelphia, Univ. of Penna. Press, 1950; Dunbar, op. cit., **3**: 902; Strickland, *op. cit.*, preface.

[44] See Shelling, *op. cit.*, **62**: 175–176; Bishop, *op. cit.*, 171–173; *A compilation of the canal and railroad laws of Pennsylvania*, 3–4, Harrisburg, 1836.

the Alleghenies and thus save a large amount of lockage in the most difficult section; nevertheless, 2,595 feet of lockage would remain in the 270 miles between the Susquehanna and Pittsburgh, 1,329 feet of it in the mountain section. This compared with a total of 689 feet of lockage on the Erie Canal. The suggested canal prism was slightly smaller than that of the Erie: 24 feet wide at the bottom, 40 feet wide at the water line, and four feet deep, compared to the Erie's 28 by 40 by 4.

The Commissioners conceded that New York "had some advantages over us in lockage. . . ." But Pennsylvania had other and greater advantages, they thought: convenience of materials along the route, the current low rate of interest, lower wages, cheaper provisions, more experienced workmen, the possibility of avoiding the construction errors made on the Erie, and a warmer climate that would permit a longer season of navigation. Hence they were extremely optimistic. The tolls from this great work, they predicted, would eventually entirely support the state government and educate every child in the commonwealth.[45]

However, the majority report of the Canal Commissioners was succeeded within a few days by a minority report that threw a dash of cold water on all the high hopes. For the third commissioner, Charles Trcziyulney, took an extremely sceptical view. With remarkable caution for those days, he refused to decide on the most suitable route without a thorough examination of all the proposed routes—a task for which the Commissioners had lacked both the time and the experienced engineer. More important, he considered the tunnel proposal entirely impractical: it would be extremely expensive, it would take an enormous amount of time because of the limit on the size of the digging force at any one time, and it required too many locks on each side of the tunnel in too short a space. In his opinion, a canal in the summit area was out of the question: "the whole country . . . is mountainous; mountain rising after mountain in quick succession. . . . Here nature has refused to make her usual kind advances to aid the exertions of man; mountains are thrown together, as if to defy human ingenuity. . . ." [46]

The commissioners' reports touched off an intense year-long public discussion. On the one hand, the recommendation of a canal and of a definite route on the basis of very little information aroused the opposition, not only of the sections opposed to any canal, but also of the areas on the alternate routes. A February 7 meeting of the citizens of Centre County was the first to protest, and the complaint was a simple one: only one of the three possible routes had been explored. The meeting indignantly demanded further surveys before a decision was made.[47] On the other hand, the Trcziyulney report brought to a head the serious doubts afflicting many of the advocates of a "mainline" concerning the feasibility of a canal over the mountain range. The proposal for a four-and-one-half-mile tunnel was particularly disturbing. Tunnels were relatively new, so long a tunnel unheard of. It was natural, therefore, for many to turn to the railroad as a possible solution. The debate on whether to build a canal at all was from this point on supplemented by a debate within the mainliners' ranks on the relative merits of canals and railroads.

Although there was as yet no railroad in the United States, there was a railroad enthusiast. For a decade and a half John Stevens had been trying to bring the new method before the attention of the public. In 1811 he applied to the New Jersey legislature for a railroad charter; in 1812 he seriously proposed to the New York Board of Commissioners for the Improvement of Inland Navigation that they build a railroad instead of the Erie Canal; and in 1815 he received from New Jersey the first American railroad charter. But he was unable to raise the capital for so daring a venture as a railroad from the Delaware to the Raritan, and his charter lapsed.[48]

In 1820 Stevens turned his restless attention to Pennsylvania. Foreseeing tremendous advantages in a Philadelphia-to-Pittsburgh railroad—he predicted that it would draw the trade of the entire west to Philadelphia—he offered to run a quarter-mile railroad on Philadelphia's Market Street to demonstrate its potentialities.[49] The City Council showed no interest in a Stevens demonstration, but he obtained a somewhat more sympathetic hearing from Philadelphia's businessmen, who were becoming agitated by Erie Canal construction and by the development of steamboats on the Mississippi River.[50]

In 1822 Stevens applied to the state legislature for a charter for a Harrisburg-to-Pittsburgh railroad that would connect the Union Canal, then under construction, to the west. But the legislature, afraid of Baltimore's demonstrated ability to attract Pennsylvania's produce down the Susquehanna, gave him instead, in 1823, a charter for a "Pennsylvania Railroad Company"

[45] Pennsylvania Board of Commissioners for . . . Internal Improvement, *Report*, dated February 2, 1825, in Pennsylvania House of Representatives, *Journal*, 1824–1825, **2**: *passim*.

[46] Pennsylvania Board of Commissioners for . . . Internal Improvement, *Report of Charles Trcziyulney*, dated February 21, 1825, in Pennsylvania House of Representatives *Journal*, 1824–1825, **2**: *passim*.

[47] See *U. S. Gazette*, February 14, 1825.

[48] Metre, Thurman Van, *Early opposition to the steam railroad*, 15–19, (New York), Columbia University School of Business, n.d.; Haney, Lewis H., A congressional history of railways in the United States to 1850, in *Bull. Univ. of Wisconsin*, No. 211, 23, 1908. Stevens, John, *Documents tending to prove the superior advantages of rail-ways . . .*, New York, 1812, reprinted in *Magazine of History* **14**, Extra No. 54, *passim*, 1917.

[49] Historical Records Survey. New Jersey. *Calendar of the Stevens family papers: preliminary volume*, 75–76, letters dated December 4, 1820, January 5 and 15, 1821, Newark, Hist. Records Survey, 1940.

[50] Livingood, *op. cit.*, 142.

from Philadelphia to the Susquehanna at Columbia. Stevens managed to attract some influential support for this project: Stephen Girard and Horace Binney were among the incorporators, and Mathew Carey and Robert Patterson, among others, agreed to serve as directors. Attracting capital, however, was a different matter. There was general scepticism about a railroad as unprecedentedly long as seventy-three miles, and a disbelief that a locomotive could operate on anything but an absolutely level track. Furthermore, there was serious discussion by this time of the possibility of a canal from Philadelphia to the Ohio.[51] In a long circular letter to the public, Stevens attempted to counter the general opinion: a long railroad was in principle no more difficult than a short one; and the proposed line would at no point rise more than two degrees from the horizontal.[52] But he could not raise even the $5,000 necessary to construct a test mile.

During the following two years, however, American attitudes toward the railroad were profoundly influenced by the news of a railroad mania in England. The mania developed as part of a general speculative boom, but it was also based upon the important advances in railroad technology accomplished since the beginning of the century. By 1825, railways connecting all the largest cities were being planned and at least five railway companies, in addition to thirty dock, loan, insurance, and similar types of companies were being floated. These flotations were mainly speculative—few schemes reached the construction stage—but the building of the Stockton and Darlington Railroad increased the general enthusiasm.

The timing as well as the success of the Stockton and Darlington were extremely important for the development of the Pennsylvania debate. A charter for a horse-drawn railroad carrying only freight was obtained from Parliament in 1821, and George Stephenson was appointed engineer. In 1823, when the roadway was far advanced, the company obtained an amended charter which permitted the use of locomotive and stationary engines for the hauling of both goods and passengers and which gave the right to all to place their wagons on the road on payment of a toll fixed in the Act. The Stockton and Darlington was eminently successful and an important factor in that success was speed. When it opened, on September 23, 1825, observers were amazed to see a locomotive haul a train weighing at least eighty tons up an incline at ten to fifteen miles per hour. However, the line was not a modern general-purpose railroad in the full sense, for it drew mainly coal and its passenger traffic developed slowly before 1832.

With the success of the Stockton and Darlington assured, eighteen new railroads were authorized by Parliament in 1826. But three of the most important of these had been projected before the Stockton and Darlington opened. The campaign for the Liverpool and Birmingham began in 1824; there was some agitation for a Birmingham and London Railroad in 1825; and the first prospectus for the Liverpool and Manchester was issued in October, 1824.[53]

All these developments were reflected in the Philadelphia press. The *National Gazette* of January 20, 1825, quoted a petition for a "general iron Rail Way" to the city of London which listed the advantages of railroads and enlarged on "the folly of making canals . . . in the neighborhood of London. . . ." The editor was greatly impressed: "The prodigies to be effected with Rail Roads are strikingly exhibited. . . ." In another Philadelphia daily, one writer quoted the London *Gentleman's Magazine* on railways and had no doubt of their application to many parts of Pennsylvania, another proposed a railway instead of the Schuylkill-Delaware Canal, and a third described the growing importance of iron railways.[54] In February the state senate responded to the growth of railroad interest with the appointment of a committee to investigate the possibility of building a railroad from Philadelphia to Pittsburgh.[55]

In the same month, the Pennsylvania Society published a pamphlet on railroads that consisted of a digest of an essay by the well-known British engineer, Robert Stevenson. It went through three editions within six weeks and was reprinted in full in the *United States Gazette* of March 3. Stevenson's explanation of the recent rapid development of railroads in Scotland and Wales must have been of particular interest to his American

[51] *Ibid.*, 142–144; Gregg, Dorothy, The exploitation of the steamboat: the case of Colonel John Stevens, 313–316, unpublished dissertation, Columbia Univ., 1951; Turnbull, Archibald Douglas, *John Stevens*, 447–448, 467, New York and London, Century Company, 1928; Van Metre, *op. cit.*, 19; Dunbar, *op. cit.* **3**: 892. On April 10, 1823, Binney wrote Stevens that he regretted the use of his name and wished to resign as soon as the board was organized. See *Historical records survey, New Jersey*, 77, document 1373. For Carey's acceptance of a directorship in December 1823, see *ibid.*, 79, document 1380. According to Gregg, *op. cit.*, 315, Carey wrote Stevens at this time that he was enthusiastic about the proposal of a railroad between the Susquehanna and the Allegheny rivers. *Historical records survey, New Jersey*, 79, document 1377, contains a letter from Stevens to Jacob Holgate, dated January, 1824, which listed those who had consented to serve on the Board of Directors of the Pennsylvania Railroad Company: Richard Peters, Jr., Mathew Carey, Robert Patterson, Caleb Newbold, Jr., John Redmond Coxe, John Connelly, Stephen Girard, and Emmor Bradley.

[52] Dunbar, *op. cit.* **3**: 894.

[53] Jackman, *op. cit.* **2**: 477–483, 510n, 531–532, 535–545; Veitch, George S., *The struggle for the Liverpool and Manchester Railroad*, 33, Liverpool, Daily Post, Printers, 1930; Strickland, *op. cit.*, 23.

[54] *Poulson's*, January 25, February 3, and February 9, 1825. See also the issue of March 11, 1825.

[55] *U. S. Gazette*, February 11, 1825; Dunbar, *op. cit.* **3**: 178n; Wilson, William Bender, *History of the Pennsylvania Railroad Company* **1**: 96–98, Philadelphia, Coates, 1899. I have not been able to find any report by this Senate committee.

readers. It was England's great wealth, he explained, that had allowed her to be first in the development of canals and other waterways. Her less wealthy neighbors were now trying to make up for their lack of these improvements by constructing numerous railways, "which are perhaps better adapted than canals to the undulating surface of their respective countries; while they are most economical and more generally applicable to the ordinary purpose of commercial traffic." [56] Thus, everything happening in the British Isles at the time—the technical advances in track and locomotive, the projects for general-purpose railroad lines between the urban centers of England, railroad construction in Scotland and Wales, above all, the imminent opening of the Stockton and Darlington—all spoke in favor of keeping an open mind on the question in Pennsylvania.

All of the railroad interest in the Philadephia press thus far described was purely informational; it represented no public debate. On February 18, however, the first flash of battle appeared in the *United States Gazette* in the form of an editorial blast against railroad advocacy in Pennsylvania. The editor began with relatively calm references to the lack of railroad data and the need to wait for the report from Europe of the Society's agent—a tranquilizing theme often to be used by the mainline leadership in the succeeding months. But in the meantime, the editor added, it was worth arguing whether the vast advantages of canals were to be entirely given up "because there is a possibility that some more *plausible* undertaking *may* be proposed." The editor was deeply disappointed in the railway advocates: "we had hoped that a majority of our citizens were prepared to make a sacrifice of narrow prejudice and selfish views, upon the altar . . . of public good." The phrase was remarkably bitter; "narrow prejudices and selfish views" was the stock characterization formerly reserved for those who opposed any mainline. But this was only a mild beginning. Before the debate was over, canal advocates were accusing the railroad party of "throwing foreign dust in the public eye. . . ." [57]

By March the great debate was in full swing. The railroad party threw down the gauntlet with publication of an anonymous pamphlet that in its various editions was to become the central point of defense and attack during the subsequent months.[58] This first full statement of the pro-railroad position in Pennsylvania judiciously reviewed and answered all the arguments against the railroad and boldly proposed a full railway line from Philadelphia to Pittsburgh. The railroad would utilize the existing bridges over the Susquehanna, employ inclined planes over the Alleghenies, and would cost but $3 million. Horses would provide the sole motive power except on the inclined planes, where extra horses, steam engines, or water power might be used.[59] The author heralded the dawn of the railroad age: ". . . may we not confidently anticipate the period when canals will no longer be generally used; and that railroads will be known as the only rational means of conveyance?" [60]

The first full-scale review of the route and railroad questions by a leader of the state's mainline forces appeared in a pseudonymous article by Mathew Carey in the *United States Gazette* of February 16.[61] To Carey, the principal problem posed by these issues was the dissension they aroused in mainliner ranks. "These differences of opinion threaten greatly to retard for the present, or even to defeat the object we all have in view." And they came at a dangerous time, when New York's enterprise "is gradually undermining the foundations of our prosperity. . . ." The mainline's interest demanded a suspension of the argument; "let us all unite, heart and hand, in the purpose of opening a communication, and let the mode and the route be subjects of future consideration, after proper exploration." More information on railroads was required: "we are much in the dark on this subject. . . ." Light would soon be shed by Strickland's reports from Europe, which were expected in July or August, early enough to enable the leaders of the movement to form "sound views" in time.

Having made the plea for a suspension of the debate, Carey went on to give his opinions on the relative advantages of railroads and canals, evidently with the purpose of moderating any dangerously optimistic views of railroads. The argument was couched in judicious terms. Carey saw considerable advantages in railways: the greater speed; the diminished liability to obstruction and delay, especially during the winter; the ease of repair. But there were serious difficulties to be overcome: the American frosts, much more intense than those in England; the heavy expense of railroad construction; and, "more than all," the great elevation.

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[56] Pennsylvania Society . . . , *Railways—second edition*, 1–2, [Philadelphia], [1825]. The first edition is dated February 25; the second, March 22; the third, April 5, 1825. The second edition contains a preface by the Acting Committee of the Society.

[57] "Tweed," *U. S. Gazette*, August 30, 1825.

[58] *Internal improvement. Rail roads, canals, bridges, etc.*, [Philadelphia], [1825]. The pamphlet is dated March 15, 1825.

[59] *Ibid.*, 26–27. The arguments for the railroad will be described below in connection with subsequent enlarged editions of this pamphlet.

[60] *Ibid.*, 21. According to Gilchrist, *op. cit.*, 67, this pamphlet contains the first printed suggestion for a trans-continental railroad.

[61] "Canals and railways—No. 4." The six consecutively-numbered articles in this series appeared between December 8, 1824, and March 28, 1825. The first three and the fifth articles are entitled "Canal policy." The sixth is entitled "Internal improvement." All are signed "Fulton," which, with "Hamilton," were Carey's customary pen names. On the question of authorship, see Rowe, *op. cit.*, 89–93 and bibliography. One of Carey's opponents in the railroad debate, "Audi Alterem Partem" (John Stevens), referred to "A writer . . . whose signature of 'Hamilton' leads all the world to recognize the . . . author of many pieces on political economy, cotton trade, etc. . . . " See *U. S. Gazette*, October 15, 1825.

Carey conceded that the problem of frost might be overcome by sinking the blocks on which the rails rested to a greater depth than was the practice in England, and recommended a small-scale experiment to determine the effectiveness of this method. Concerning cost of construction, Carey quoted an "able and elaborate memorial drawn up at Pittsburgh" which estimated the cost at $8,000 per mile but which did not say whether this was for a single or double set of tracks. Carey conceded that if a complete railway could be built for $8,000 or even $10,000 per mile, "the idea of a canal ought to be abandoned . . . in favor of a grand railway through the whole route." But he was doubtful of the Pittsburgh cost estimate. The Manchester and Liverpool Railroad, he pointed out, was built on relatively level ground, had only a single set of tracks, and had the advantages of English skill and experience and cheap labor. Nevertheless, it would cost $54,000 per mile. At that rate, he estimated the cost of a Philadelphia-to-Pittsburgh railroad at $16,200,000—an impossible sum in his opinion. A double railroad would cost 50 per cent more. Clearly, Carey was extremely sceptical, but his principal concern was to avoid the damaging effects of the spread of dissension on the issue.

The Pennsylvania House Committee on Inland Navigation and Internal Improvement followed about the same line in its February 28 report. The Committee noted that it had received numerous inquiries "from the most respectable sources" concerning the construction of railroads instead of canals. It noted too that railroads in England had hitherto been used for very limited purposes but that numerous experiments on a large scale were now in the making. Delay until the next meeting of the legislature was therefore advisable. But the Committee, like Carey, felt it advisable to add a dash of scepticism. "As regards canals, we have experience for our guide, in our climate and upon our soil." The remarkable consequences of the Erie Canal, the Committee pointed out, were known to all. Everyone knew too that the costs of a great canal were within Pennsylvania's means. But there was "no certain data" on which to base an estimate of the cost of a complete railway in a mountainous country. Nevertheless, the Committee, while urging continued canal surveys, recommended the "railroad system" to the early attention of the next legislature.[62]

As for the Pennsylvania Society, its publications stressed that it favored no particular route or mode of communication, that its only function was to press for a mainline in general and to find and disseminate facts about internal improvements. There is no reason to doubt that this policy of neutrality reflected the real opinions of the Society's leaders in this period. True, the Society published essays on the advantages of canals and on the necessity and benefits of a water communication between the Susquehanna and the Allegheny.[63] But not only did it publish the highly favorable pamphlet on railroads described above; it also lobbied in the Pennsylvania and New Jersey legislature during the first half of 1825 on behalf of the railroad ventures of one of its charter members, John Stevens.[64]

The Strickland mission is further evidence of the openmindedness of the Society's leaders. Their instructions to him regarding railroads stressed the lack of knowledge in the United States upon three subjects: mode of construction, expense, and the maximum angle of ascent on which a railroad would be advantageous. The instructions pointed out that, though railroads were still "subjects of controversy and doubt" in England, Strickland would arrive there at a particularly fortunate time, for "The great communication . . . between Manchester and Liverpool and between Birmingham and Liverpool will have been commenced, or all the principles and plans . . . will have been . . . determined." The Society stressed the need of a prompt report; Strickland was ordered to commence his railroad inquiries before his other assigned subjects and to transmit his information as quickly as possible.[65]

Thus, by March of 1825 the issue between railroad and canal was fully posed but, for the leadership of the mainline movement, not yet joined. For it was understood that action in America could not as yet depend on debate in America. "The railroads which are about to be made in England, will furnish the best data upon which to reason and act in this country."[66] Furthermore, the instructions to Strickland indicate that there was general confidence that the data soon to come from England would be sufficient to settle the issue. The principal problem, therefore, was to avoid the development of an all-out battle within the mainline party before the decisive data arrived. Hence the protestations of impartiality and the pleas for a suspension of opinions were oft-repeated and

[62] 5, Harrisburg, [1825].

[63] See Shelling, *op. cit.*, 181.

[64] Stevens was trying to obtain a New Jersey railroad charter and to revive his charter for a railroad from Philadelphia to the Susquehanna. See *Historical records survey, New Jersey, op. cit.*, 81–83, documents 5417 and 5461. Gregg, *op. cit.*, 316, states, in reference to the formation of the Society, that "each member paid $100 towards building up a fund to be used in promoting railroads." This is an error. The $100 was an initiation fee used to promote internal improvements of all kinds. The Society was always careful to establish its impartiality in regard to modes of communication, routes, etc. It did state that the high dues were necessitated by such expenses as Strickland's mission to Europe to investigate, among other things, railroads. But fact-finding is not always the same thing as promoting.

[65] Pennsylvania Society . . . Acting Committee, *First annual report*, 34, "Mr. Strickland's instructions (copy)." The decision to send Strickland to Europe was taken at the January 19 meeting of the Society; he left for Europe on March 20th. See *ibid.*, 10–13.

[66] *National Gazette*, Philadelphia, March 24, 1825.

more and more urgent. In March, the Acting Committee of the Society no longer automatically called for a "canal communication," but for the "opening of a communication by canals (or railways should they appear, on full examination, to be preferable, or by both canals and railways)." And while affirming its impartiality regarding both mode and route, the Committee deprecated "as a most serious calamity" any difference of opinion that might cause dissension. The important thing was to concentrate all energies upon obtaining a mainline.[67] Carey's next article even suggested that the bill for the appointment of a new Board of Canal Commissioners should direct the engineers to determine suitable locations for railways as well as for canals, because railways "may, on full examination, be found preferable to canals, particularly in mountainous parts of the country." In view of Strickland's mission, Carey was certain that "full and ample information on the subject" would be available in three to five months, "which will be sufficiently early for the purposes of the commissioners." [68]

The leadership's appeal for a few months' postponement of the railroad discussion was successful; the case for delay was strong and Strickland's "full and ample" information was promised very soon. During April, May, and June the railroad as an issue virtually disappeared from the Philadelphia press—only scattered references to English railways remained—and interest again centered upon agitation for a mainline in general. However, Carey's suggestion that the mainline bill should be worded impartially as to mode of transportation was not heeded. The new bill, which became law on April 11, 1825, called for appointment of a board of five canal commissioners, which was to prepare the establishment of a "navigable communication" across the state and to Lake Erie.[69] But the wording of the bill did not matter very much. Action was still in the survey stage and surveys were not begun until the new board was organized in July.[70]

The April law was a long step forward, but mainliners were still far from their goal of actual appropriations for construction. Further pressure on the legislature was required. Consequently, a committee of twenty-four which had been set up by a Philadelphia mass meeting the previous January to carry on agitation for the mainline, issued a call in April for a statewide internal improvement convention to be held at Harrisburg during the coming summer. A Philadelphia town meeting was called for May 3 to set up the preliminary arrangements for the convention.[71]

Like the January meeting, the May 3 meeting had to be adjourned because of the lively discussion, this time for and against a convention. There were two principal objections: some thought that the convention would provide anti-mainliners with a forum which they would utilize to create dissension; others believed that the convention was unnecessary because the entire state was already aroused to the need for a mainline.[72] Mathew Carey's answer to the latter objection throws light on the strength and composition of the mainline movement. It was true, he wrote, that meetings in almost every county of the state had sent mainline memorials to the legislature. But he estimated that all these meetings together had hardly comprised 5,000 persons. Furthermore, "The mass of memorials were either from this city, or prepared at the instance of the Society . . . or the committee of twenty-four." Carey wanted a convention to influence the hundreds of thousands not yet aware of the importance of the mainline or opposed to it for sectional reasons.[73]

At the adjourned Philadelphia meeting on May 6 a large majority approved the resolutions for a convention. These carefully referred only to a mainline "communication" but they commended the state for the April law which called for a "navigable communication." The railroad issue was definitely in limbo for the time being.[74] The meeting decided that the number of delegates should correspond to the number of representatives from each political division of the lower house of the legislature and consequently sent six from the city and seven from the county of Philadelphia. Ultimately, forty-eight of the fifty-one counties in the state sent delegates, but the strength of the opposition to the mainline made many of the county meetings stormy affairs.[75]

The great Internal Improvement Convention met at Harrisburg from August 4 to August 6 and passed the customary resolution for a "line of communication" by the "best practicable route"—thereby avoiding both the route and railway issues. It took a strong stand, however, against ". . . diffusive and unconnected application of the public means. . . ." [76] The convention then rejected a resolution introduced by Charles J.

[67] *U S. Gazette,* March 22, 1825. The article is dated March 4, 1825, and is signed by the fifteen members of the Acting Committee, headed by Mathew Carey.

[68] "No. 6—Internal improvement," 4–5, March 28, 1825.

[69] *A compilation of the canal and railroad laws of Pennsylvania,* 4–7.

[70] The new canal Commissioners, appointed during April, were Robert M. Patterson and John Sargeant of Philadelphia, William Darlington of Chester County, David Scott of Luzerne County, and Albert Gallatin of Fayette County. Gallatin declined and General Abner Laycock took his place. Sargeant was elected president of the Board, William Wilson was appointed chief engineer, and William Strickland was appointed consulting engineer. See Bishop, *op. cit.,* 180.

[71] Shelling, *op. cit.,* 185.

[72] *U. S. Gazette,* May 5, 1825; Shelling, *op. cit.,* 185.

[73] *Poulson's,* May 6, 1825. Signed "Fulton."

[74] *U. S. Gazette,* May 9, 1825; Shelling, *op. cit.,* 185–188.

[75] Shelling, *op. cit.,* 188–189.

[76] Bishop, *op. cit.,* 266. *Niles' Weekly Register* **29**: 63, September 24, 1825, quotes the *Pennsylvania Intelligencer* as to the occupational distribution at the convention. Among the 117 delegates were 47 lawyers, 30 farmers, 16 merchants, 7 manufacturers, and 2 mechanics; the remaining 15 were miscellaneous businessmen and professionals.

Ingersoll and William J. Duane of Philadelphia which recommended a mainline railroad and lateral railroads to the "early and earnest consideration of the constituted authorities of the state." [77]

According to a later account by "Tweed," an anti-railway mainliner, Ingersoll remarked when offering his resolution that if railways were not adequate to all purposes of transportation, they were at least necessary auxiliary aids to canals. "Tweed" remarked that he had no objection to auxiliary railroads: the London and Liverpool, for example, "is merely calculated for that purpose." His only objection to Ingersoll's resolution, then, was that it was premature:

> we ought to construct the *principal* prior to *aids*. Bring out our resources by the construction of Canals; and subsequently, when our iron, by the increase of its manufacture, is reduced to a reasonable price, and rail-ways are found practicable and necessary to *aid* our canals, we may then construct them with prudence.[78]

Thus, the railroad was treated merely as an auxiliary, useful only where geographic conditions prevented construction of a canal. Used in this way, the railroad made it possible to promise something to every section of the state regardless of topography. This attitude was taking shape at a time when the mainline movement was officially neutral on the railroad-canal issue, officially merely waiting for information from England, and officially opposed to branch lines. "The great object is undoubtedly to open a Canal Communication," wrote a mainliner in the period before the Harrisburg convention, but lateral canals and, where these could not be made, turnpikes and railroads, would come later and perhaps even simultaneously with the mainline: ". . . it is not . . . contemplated . . . to confine the acts of the convention, to a central canal. . . ." [79]

But the issue of a mainline railroad was far from dead. After three months of relative quiescence, it flared up again in the summer of 1825 and continued unabated for the remainder of the year. The first important stimulus to debate came in July with the publication of *Facts and Arguments in Favour of Adopting Railways in Preference to Canals in the State of Pennsylvania,* a new, much-enlarged, and widely-circulated edition of the railroad pamphlet described above.[80] The pamphlet provided a thorough discussion of all the technical problems and advantages of the railroad, together with some acute comments on the future of the railroad for the world, as well as its importance for Pennsylvania. According to Carey, it was "circulated through the state with great zeal and industry. . . ." [81] Judging from the number of times it was referred to during the debate, it became the basic reference work for both the pro- and anti-railway forces.

The author of *Facts and Arguments* pointed out that there was every reason to expect a continuation of the rapid technical development of the railway. Prevention of the oxidation of iron, lighter and stronger cars, a gas vacuum engine to supersede the steam engine, smaller axles, and other developments were mentioned as possible or probable.[82] In view of these potentialities, "It does not require the voice of prophecy to predict that . . . the New York canal will be superseded by a railway." [83] But before that event it would become evident that Pennsylvania's delay in effecting a communication between the Ohio and the Delaware, so often regretted by the "enlightened citizens of Philadelphia," was really a blessing in disguise. It had prevented the loss of the capital on a canal and thus made possible a railroad that would "monopolize the commerce of the Western country," for the route from New York to Pittsburgh via the Erie Canal, Lake Erie, and the Allegheny River required four transshipments and was frozen five months of the year, while the railway route from Philadelphia would require no transshipment, would operate all year, and would

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[77] *Niles' Weekly Register,* **29**: 62, September 24, 1825; Shelling, *op. cit.,* 197. See also Meigs, William M., *The life of Charles Jared Ingersoll,* 153–154, Philadelphia, Lippincott, 1897.

[78] *U. S. Gazette,* August 30, 1825.

[79] "Brindley." *U. S. Gazette,* June 3, 1825.

[80] Henceforth to be referred to as *Facts and arguments.* This 66-page pamphlet, dated July 20, 1825, was a revised and enlarged third edition of the 28-page pamphlet, *Internal improvement. Rail roads, canals, bridges, etc.,* dated March 15, 1825. A fourth edition, dated August 1, 1825, added as an appendix Strickland's first report on railroads (described in the text below). All editions were published anonymously in Philadelphia. Thomas Richard Thomson's *Check list of publications on American railroads before 1841,* New York, New York Public Library, 1942, treats the two titles as unrelated pamphlets, but comparison reveals identical paragraphs throughout.

The United States Gazette reprinted *Internal improvement. Rail roads, canals, bridges, etc.* in its issues of March 24, 28, and 30, 1825; then in an editorial on July 26, 1825, referred to the third edition of *Facts and arguments* as a new edition of the essay published by the *Gazette* in the spring, an edition which had been "revised by the author, and carefully accommodated to the recent information which the . . . society . . . has obtained. . . ." The same editorial praised the Pennsylvania Society for distributing *Facts and arguments* without charge. On September 28, the *Gazette,* in response to objections to this statement, apologized for having given the mistaken impression that the Society had anything to do with the pamphlet.

The pamphlets have been variously attributed to William Strickland, Mathew Carey, and George Washington Smith. Internal evidence rules out Strickland (see Gilchrist, *op. cit.,* 67); Carey is also out of the question, for he bitterly attacked *Facts and arguments* and its author. There is evidence that Smith was the author: in an article signed "S" in the *United States Gazette* of December 24, 1825, the writer referred to himself as the author of *Facts and arguments.* Cleveland and Powell, *op. cit.,* 328, attributed the pamphlet to Smith. Carey, in attacking the pamphlet, referred to the prolific pro-railway newspaper debater, "Examiner," as the author of *Facts and arguments* (see his pamphlets, *Internal improvements—railways and canals, 4, 5, and 6,* p. 1 of each).

[81] *Internal improvement—railroads and canals, No. 2, 3.*

[82] *Facts and arguments,* 22–25.

[83] *Ibid.,* 58.

be half as long.[84] Furthermore, while the interregional railroad defeated the "foreign" enemy, the short-range railway would solve the vexing sectional problem. Railroads could be built so cheaply compared to canals that all the routes demanded by all the sections could be built for an amount not exceeding the cost of a canal mainline.[85]

The pamphlet had a remarkable though temporary effect upon the policy of the *United States Gazette*. The paper had opposed railroad advocacy in Pennsylvania, and two weeks before publication of *Facts and Arguments* had vigorously defended from its detractors the February majority report of the Canal Commissioners.[86] But a reading of the pamphlet led the editor to advocate a re-examination of the problem: "whatever may have been our prejudices in favor of Canals, as being the most splendid, and withall the most fashionable mode of improvement . . . ," it was necessary now to lay aside such "preposssessions." Canals, he pointed out, had been favored because of their success in New York, while railroads had not yet been tried in the United States. England, however, was beginning to erect railroads side by side with the most profitable canals, a proof of the opinion of the well-informed there. Furthermore, the pamphlet had refuted, to the editor's satisfaction, the widespread belief that the mountains presented an insuperable obstacle to the railroad. The editor was aware that "practice is to be regarded as preferable to theory." But practical demonstrations of the railroad were imminent; delay was therefore advisable. The legislature should resolve immediately in favor of a mainline, but the mode "either by Rail Road or Canal, or perhaps by both" should be decided in the light of further information. The editorial ended with a reference to a crucial source of that information: "it is understood that [Strickland] . . . will report favorably to Rail Roads."[87] The next day the paper attacked the anti-mainline editor of the *Miner's Journal* for attaching an "undue importance" to canals: ". . . he appears not to have possessed himself of the most recent reports of gentlemen of undoubted science, upon the value of railroads."

This growing railway enthusiasm was given a further great impetus when the crucial section of Strickland's first report on railroads was published in the Philadelphia press on August 12.[88] This was the information so eagerly awaited by the mainline leadership, the information that would settle the issue between railroad and canal. It was the expectation of this report that had justified the mainline leadership's successful attempt to postpone the divisive railroad debate. In view of its central importance, it is worth quoting in full:

> As to the relative advantages of railways and canals in mountainous or level countries, there appears to be but one opinion among the ablest Engineers in England; both modes of transportation have been practically tested, and although much wealth and commercial greatness have been produced by numerous canals, still railroads offer greater facilities for the conveyance of goods, with more *safety, speed,* and *economy.*
>
> It is a matter of little importance whether the surface of the country where they are introduced be level or mountainous; these objects are still attained without difficulty; if *level,* horses or locomotive engines are to be used with great advantage; if *mountainous,* a stationary steam-engine or brake is to be applied on the summit; while the ascent is to be overcome at once, by means of an inclined plane. It would not perhaps be proper for me to eulogize this system of internal improvements in a report which is solely intended to convey facts; but I feel it a duty which I owe to my own judgment, as well as to that of the liberal Society whom I have the honor to serve, to state distinctly my full conviction of the *utility* and decided *superiority* of *Railways* over other modes as a means of conveyance; and one which ought to command the serious attention and adoption by the people of Pennsylvania.[89]

The publication of this report marked the end of whatever remained of the railroad truce. Indeed the Philadelphia press developed an enthusiastic interest in railroads, an interest that was fed by the news of the railroad mania in England. The following selection of railroad items appearing in Philadelphia newspapers during the fall and winter of 1825 will illustrate the trend. In September plans were reported for the exhibition of a 1,000-yard railway and a locomotive on Capitol Hill in Harrisburg for the benefit of Pennsylvania's legislators.[90] In October a public meeting in the Borough of Columbia declared that the superiority of railroads over canals had been proven by the projects in England and by the opinion of all the ablest engineers, including Strickland. The meeting called for the immediate construction of a Philadelphia to Columbia railroad.[91] In November came the impressive news that the continent was falling into step with the British Isles. Strickland reported plans for an 80-mile railroad between Hanover and Hamburg, while another source reported the building of a 280-mile iron railroad in Poland between Kalish and Brezec.[92] Furthermore, the locomotive was proving

[84] *Ibid.,* 58–59.
[85] *Ibid.,* 52.
[86] Editorial, July 11, 1825.
[87] July 26, 1825.
[88] It was sent from Edinburgh and dated June 5. Both the *United States Gazette* and *Poulson's American Daily Advertiser* carried it.

[89] The above extract should be compared with the following statement in Bishop, *op. cit.,* 176: "He [Strickland] did not apply the information he received to American conditions, nor did he recommend the adoption of either railways or canals in Pennsylvania. In all points of public policy he was entirely noncommittal." Bishop evidently used as his source the published volume of Strickland's reports, from which the above extract was deliberately omitted. See below, p. 60.
[90] *Niles' Weekly Register* **29**: 35, September 17, 1825. There are no further reports on this project.
[91] *U. S. Gazette,* October 14, 1825.
[92] *Ibid.,* November 23, 1825. The latter report was undoubtedly false.

itself. From London came a detailed account of the powers and advantages of the kind of locomotive used so successfully on the Stockton and Darlington. The locomotive traveled "with ease and safety with a weight of 90 tons in its train, at the rate of eight miles an hour" and thereby proved the great advantages of the railroad over the canal.[93]

Thus the leaders of the mainline movement were confronted with a rapidly developing railroad enthusiasm. According to its own later account, the response of the Acting Committee of the Society to Strickland's first report was also enthusiastic. The Committee praised its comprehensiveness, for it provided every bit of information required to introduce railroads into the United States. Strickland also procured for the Society a working model of a locomotive engine. "A machine so valuable, of such astonishing competency," the Committee declared, "ought to be more generally known in our country." [94]

Nevertheless, the Committee was disturbed by the rapid growth of railroad interest and decided that it must quickly obtain from Strickland a more detailed, and possibly a more qualified, opinion on the merits of railroads. Its letter to him of September 19 anxiously referred to the excitement in the state on the railroad issue and enlarged on its possible effects: "It is feared by many, that . . . it will divide the friends of the cause of improvement, and thus postpone, if not prevent the commencement of the great work." [95] The Committee therefore demanded certainty; Strickland was warned that unless he furnished "facts and arguments of an entirely conclusive nature" in favor of railways, Pennsylvanians "will pause," for they did not have his opportunities of testing the railroad's advantages. A series of questions followed: did Strickland contemplate using railroads for both goods and passengers, and if so, was not a double railroad needed for each purpose? Did he contemplate the use of locomotives on railroads in Pennsylvania? Had he considered the difficulties of using steam engines on inclines, and in the midst of mountains far from the skilled engineers needed to repair them? Would not a railroad cost at least $20,000 per mile, if iron cost $35 per ton? Would not the demand for iron for a railroad from Philadelphia to Pittsburgh increase the price? Could present establishments in the United States provide sufficient iron within a reasonable time? The questions indicate serious doubt but also serious consideration of the railroad: "These propositions are not suggested as insurmountable difficulties, but as specimens of the matters which will be required of you when you return." Indeed, the Committee ended with a reassertion of its impartiality: "It is not for the Pennsylvania Society to adopt a preference for any particular plan of improvements, or to discourage investigation. Its object is the improvement of the state by the best plan. . . ."

In his answering letter from Liverpool, dated October 20, Strickland politely rejected the Committee's implication that his opinions were contributing to a dangerous railroad-canal division. As to the specific questions, he explained that two pairs of tracks—which, he emphasized, had to be edge rails—would be sufficient. But, he added, they must be constructed for use by locomotives, for only with these did the railroad have a decisive superiority over the canal. Strickland was convinced of the "practical efficiency" of the locomotive on moderate inclines as well as on levels. For steeper grades he advocated the current English practice of inclined planes and stationary engines. Locomotives, he thought, would be much more efficient than were horses on canals; and stationary engines and inclined planes were much cheaper to construct than were canal locks, while their maintenance and repair were not more difficult. He admitted, however, that railroad construction would force up iron prices and that the inability of the state's industry to supply sufficient iron within a reasonable time would be a great disadvantage.

All these specific arguments were important; but Strickland's concluding remarks took up a more basic source of the Committee's anxieties. The railway in England, he conceded, had been satisfactorily proven on a relatively small scale, and for limited purposes. True, it had succeeded on "varied surfaces of country," and Englishmen "of intelligence and capital" were confident of its general extension. But he acknowledged that his "honest opinion derived from a personal investigation of *facts* [which] . . . may be presumed to have been exhibited, *perhaps* upon too *small a scale* in England, to admit of an unequivocal recommendation to your society, or the people of Pennsylvania. . . ."

A week after the Acting Committee of the Society had addressed its anxious letter to Strickland, its chairman, Mathew Carey, launched an all-out campaign against a railroad mainline. His action must have been a complete surprise to many mainliners. As chairman of the Acting Committee, Carey had emphasized its impartiality.[96] As an individual writing under his well-known pseudonyms of "Fulton" and "Hamilton," he had professed neutrality while counseling caution until the facts were unearthed by the Strickland mission. So uncommitted did he seem at the time in both his personal and his official capacities that, despite a scepticism toward the railroad that is evident in his writings from the beginning, *the United*

[93] *U. S. Gazette,* December 29, 1825, reprinted from the (London) *John Bull.*

[94] Pennsylvania Society . . . Acting Committee. *First annual report,* 19–20.

[95] Pennsylvania Society . . . Acting Committee, *Internal improvement. Extracts from correspondence with William Strickland,* n.p., n.d. The pamphlet, dated Philadelphia, December 21, 1825. contains the Committee's letter and Strickland's answer.

[96] See especially, Pennsylvania Society . . . Acting Committee, *First annual report,* 9.

States Gazette could mistakenly assume that the Society had published the best-known document of the pro-railroad party, *Facts and Arguments;* an anti-railway debater could complain that the pamphlet was ". . . decidedly patronized by the society . . . ," and another writer could assume that Carey had written the pamphlet.[97] Another factor likely to give the Society a pro-railway tinge was Carey's early recognition of the great technical difficulties of building a canal in the mountain area. Consequently he hinted at the possiblity of a railroad segment to connect the canals on each side of the mountains. Conservative opponents of the railroad—those who opposed all railways as so much nonsense—would hardly distinguish between segments and long-range lines, and might well have considered both the fact-gathering activities of the Society and the suggestions of a railroad segment as cut from the same visionary cloth.

But Carey now took a definite position. In a series of articles written between September, 1825, and February, 1826, he launched an all-out campaign against railroad advocacy precisely at the time when railroad interest in Philadelphia was reaching fever height.[98] The importance of Carey's actions can hardly be overestimated. He possessed by far the best-known name and the most skilled pen in Pennsylvania, and he had sufficient means to devote all his time to public activities.[99] In addition, as founder and vice-president of the Society and as chairman of the Acting Committee that performed the Society's day-to-day work, he was in the best of positions to influence events. His influence was such that a pro-railroad opponent felt compelled to warn that when such a man entered the lists, there was danger of bowing "to the blandishments of reputation more than to the strength of argument." [100]

Carey was not alone in his attack. His acidulous pamphlets were accompanied by a stream of bitterly anti-railroad literature from various pens, and the railroaders replied in kind. This remarkable public discussion explored every technical and economic aspect of the choice before Pennsylvania. For half a year, a flood of resolutions, pamphlets, editorials, and letters and counter-letters to the newspapers tested the public's patience for extended technical analysis, for widely-variant statistics, and for repeated rebuttal and counter-rebuttal. We have reached the decisive battle in that verbal war whose outcome was to have so great an influence upon the economic fate of Philadelphia during the next three decades. The analysis of that battle is contained in the following chapters.

[97] See the *Gazette's* correction of its error in its September 28, 1825 issue; the article by "H" in *U. S. Gazette,* September 5, 1825; and the article by "S" (who wrote as the author of the pamphlet) in the *U. S. Gazette,* September 6, 1825, which contains his denial that the Society issued *Facts and arguments.*

[98] There were two series of pamphlets: *Internal improvement —Nos. 1–6. Railways and canals,* all signed "Hamilton" and dated September 26, October 5, November 28, December 7, December 20, and December 26, 1825; and *Internal improvement. New series, 1 and 2,* both signed "Fulton," and dated January 19 and 31, 1826. In addition to these, a number of short responses to opponents appeared in *U. S. Gazette.*

[99] He had retired in 1824 with an assured annual income of about $8,000. See Rowe, *op. cit.,* 23.

[100] "Alnus," *U. S. Gazette,* November 8, 1825.

III. THE RAILROAD VERSUS THE CANAL

THE TECHNICAL AND COST ISSUES

The account in the previous chapter of events during 1825 raises a most interesting problem. Mainline leaders at first greeted the railroad idea with great interest, certainly without hostility. But by the fall of 1825 many of them considered the railroad proposal as merely divisive, as creating an issue dangerous to the mainline goal. What caused their change of attitude? It would be reasonable to suppose that it was their investigation of the technical and cost factors that changed their opinion. These factors will be described in the following order: the more general advantages and disadvantages claimed for and against the railroad, the mode of construction of railroads, estimates of the cost of construction of the railroad compared to that of the canal, and maintenance and repair of railroads compared to canals. Finally, a discussion of the attitude of mainline leaders toward auxiliary railroads will help to evaluate the importance of these technical and cost aspects in the decision of 1826.

CHARACTERISTICS OF THE RAILROAD

There was one great general advantage of the railroad, one that could not be denied by its most prejudiced opponents: it freed transportation development from dependence upon a water supply. The consequence of this independence could hardly be exaggerated. "Railroads can be constructed where canals cannot . . ."; hence areas without a water supply could now participate in the modern transportation age. Tracks could be added almost at will; hence there was no longer an absolute limit to the expansion of modern transportation facilities in a given area. A shorter, more direct line could be followed between any two terminal points; this meant great savings in haulage and construction costs; the distance between Liverpool and Manchester was more than fifty miles by canal, thirty-three miles by railroad. Finally, goods were less subject to damage when transported on land. These were the incontrovertible arguments of the railroad party.[1]

The railroad's independence of water produced still another advantage: year-round operation. Frost inevitably rendered a canal inoperative during the winter months; drought often reduced its usefulness during

[1] On all these aspects, see "Alnus," *U. S. Gazette,* December 15, 1825; *Facts and arguments,* 33; *National Gazette,* Philadelphia, March 9, 1825.

the summer. A railroad, so its advocates claimed, was unaffected by either, provided only that in winter a small scraper be attached to the lead car.[2] The superiority of the railroad in periods of drought was incontrovertible. But canal advocates ridiculed the idea of easily keeping cold iron free of ice, and pointed out that the ways had to be kept absolutely free—even dust might hinder these "ponderous machines."[3] Railroad advocates answered that a small experiment could settle the issue. If it turned out that the railroad could actually guarantee year-round all-weather delivery, the effects would be enormous: gone forever would be those perpetually-recurring alternations of glut and scarcity, as well as the need for keeping large stores of goods in expensive warehouses. Both farmers and consumers would be the gainers.[4]

But geographical flexibility and year-round operations, important thought they were, were not considered decisive; they did not by themselves prove that the railroad would be the great transportation method of the nineteenth century. Its advocates believed that the crucial advantage was the railroad's ability to increase speed indefinitely at very low extra cost. "This is the grand circumstance which distinguishes the railway from a canal, and which gives the former such an immense advantage over the latter."[5] Since the resistance to bodies moving in fluids is as the square of their velocity, the number of horses had to be quadrupled in order to double the speed. Furthermore, water vibration, also increasing as the square of the velocity, tended to destroy the banks of a canal. Hence canal boats were usually prohibited from proceeding at more than three to four miles per hour. Such a prohibition was recently instituted on the Erie Canal because of damage to the banks. In contrast, railways had only frictional resistance to contend with—at the speeds of the early nineteenth century, air resistance could be ignored—and friction, the railroad enthusiasts excitedly pointed out, increases only with pressure, not with velocity. "In this consists the great advantage. . . ."[6] The result of this advantage staggered the imagination: "It is contemplated in Great Britain to convey the mail and passengers at the rate of 15 miles per hour."[7]

The great time advantage on railroads was increased by two more factors: the immense delays caused by the canal lock system and the circuitous route often required by a canal. The former factor was especially relevant to the Pennsylvania canal; railroad advocates estimated that, even with portage or tunnel, there would be so many locks that the trip from Philadelphia to Pittsburgh would take more than two weeks. Carey admitted that it would take ten days.[8]

The canal party's answer to the speed claims of the railroad advocates was, first of all, ridicule. When the author of *Facts and Arguments* asserted that some day "the village of Astoria, 4,000 miles distant, may by the aid of locomotive engines, be visited in 240 hours or ten days," Carey answered with a single sentence: "That is, 400 miles per day, or 16 miles per hour day and night!!"—then dropped the entire ridiculous matter.[9] Of course, the difference in speed between railroad and canal could not be entirely denied. But canal advocates tried to minimize the difference: the delays produced by inclined planes and stationary engines, they pointed out, could be equal to or greater than those produced by canal locks.[10]

More important was the denial of the importance of the greater speed. For the railroad propagandists admitted that, at speeds up to two or three miles per hour, horses were more efficient on canals than on railroads because water resistance at low speeds is less than the friction to be overcome on a railroad. It was only as speeds increased beyond this point—with water resistance increasing as the square of the velocity and frictional resistance remaining constant—that the railroad acquired its advantage.[11] Since a Pennsylvania canal was expected to carry such western commodities as flour, timber, coal, iron, barley, ashes, tar—all bulky and heavy in proportion to their value—it could be argued that it was cost of transportation per pound, not speed, that was important. Since the railroad advocates admitted that at low speeds a horse was more efficient on a canal, a canal would according to this writer, provide cheaper transportation.[12]

However, the railroad's defenders denied that the efficiency of the horse was the sole determinant of the relative cost of transportation,[13] and they defended the importance of speed by referring to the faster turnover of capital and the carriage of perishable goods. The former would cheapen prices, the latter would make

[2] *Facts and arguments*, 42; "Extract of a letter . . . ," *U. S. Gazette*, August 11, 1825; "Audi Alterem Partem," *U. S. Gazette*, October 20, 1825; "Examiner," *U. S. Gazette*, December 12, 1825; "Alnus," *U. S. Gazette*, December 15, 1825.

[3] See "Look before you leap," *U. S. Gazette*, October 24, 1825.

[4] See Tredgold, Thomas, *A practical treatise on railroads and carriages*, 3–4, New York, 1825.

[5] "From the London magazine and review for January 1825," *National Gazette*, March 9, 1825.

[6] *Internal improvement. Railroads, canals, bridges, etc.*, 20; "S," *U. S. Gazette*, September 6, 1825; "From the London Magazine . . . ," *National Gazette*, March 9, 1825.

[7] *Internal improvement. Railroads, canals, bridges, etc.*, 20.

[8] "Alnus," *U. S. Gazette*, January 3, 1826; [Carey], *Internal improvement—No. 4. Railways and canals*, 1–2; "Hamilton" [Carey], *U. S. Gazette*, January 10, 1826.

[9] *Internal improvement—No. 5. Railways and canals*, 4.

[10] "H," *U. S. Gazette*, September 5, 1825.

[11] *Internal improvement. Railroads, canals, bridges, etc.*, 19, put the crucial figure at two miles per hour, as did an article in *Poulson's*, October 23, 1825. But a careful analysis in the *London Quart. Rev.*, quoted by "Audi Alterem Partem" [John Stevens] in *U. S. Gazette*, October 20, 1825, put the figure at 2.82 miles per hour.

[12] "Philo-Hamilton," *U. S. Gazette*, November 12, 1825.

[13] "S," *U. S. Gazette*, September 6, 1825.

possible abundant supplies of fresh vegetables, milk, eggs, and meat in Philadelphia.[14] Furthermore, Englishmen considered it an important augury for the future of the railroad that its speed would attract passenger traffic away from stage coaches.[15]

But there was a conditional in the velocity argument for the railroad: its defenders had to admit that the railroad's potential for greater speed—its decisive advantage, in their view—could be adequately utilized only by means of the locomotive. The rate of two to three miles per hour was about the greatest speed to be expected of a horse on a railroad, if it were to be used efficiently. This was true even when an increase in the number of horses lightened the load of each, for a horse's draught diminishes rapidly with an increase in velocity. With both railroads and canals running at two to three miles per hour, water resistance on canals was not greater than frictional resistance on railroads. This was why, according to a British writer quoted by John Stevens, "canals have been hitherto preferred to railroads." On the other hand, with the increase of speed made possible by the locomotive, the advantage of the railroad increased enormously. The British writer quoted the following figures: a locomotive could move a load of 22,400 pounds at any speed from two to ten miles per hour. The same amount of power on a canal would move 44,800 pounds at two miles per hour, 19,911 pounds at three miles per hour, 11,200 pounds at four miles per hour, 1,792 at ten miles per hour.[16] The British commentators were entirely clear and definititive on this point: "it is on this application of steam, and on the consequent capacity of maintaining a *constant action,* however great the velocity of the vehicle, that this advantage depends. Without steam a rail-way would be of no use; it would possess no superiority over a canal."[17]

For the railroad advocates, this requirement posed no problem; the success in England of the steam locomotive, and with it the future of the railroad, seemed assured. An extract of an article in the *London Courier* reprinted in Philadelphia told of the general acceptance of the locomotive in England: the Stockton and Darlington, the projected Liverpool and Manchester, and the projected Birmingham and Liverpool all planned to use locomotives. "The discovery of the locomotive engine," the article concluded, "will be almost as important to the trade and commerce of this country as the discovery of the steam engine itself."[18] Strickland was also confident; he considered the practicability of the locomotive to have been fully proven.[19]

Though the author of *Facts and Arguments* was also impressed with the locomotive—recent improvements, he noted, made possible a prodigious power with much less weight and for a very slight expense—he was not at all certain that Pennsylvania should build a railroad adapted to the locomotive. There were two considerations involved: firstly, the locomotive might not confer as many advantages in the United States as it did in England; secondly, it might make necessary a burdensome increase in American construction and maintenance costs. The locomotive, he agreed, conferred vast benefits in a country as commercial and populous as England, where great speed and the consequent increase of carrying capacity were primary considerations. In the United States, however, savings on capital costs and maintenance expenses were far more important. Horses were cheaper and machinery more expensive to buy and maintain; hence the extra expense necessitated by the adoption of the locomotive would be much greater than in England. This difference increased when mode of construction was taken into account. The British, he pointed out, used stone piers for locomotive railroads because of the locomotive's great weight—five to eight tons. Everyone agreed, however, that wooden piers were sufficient for horse railroads. Hence in the United States, where timber was so plentiful, the cost of construction of a locomotive railroad would be two or three times that of a horse railroad. But the author of *Facts and Arguments* did not consider it necessary, in 1825, to take a definite position on the issue. It was quite possible, he believed, that the British construction method would turn out to be unnecessary; that, in fact, wooden piers could support a locomotive. He therefore urged experimentation. If wooden piers could be used, then a railroad adapted to both horses and locomotives should be built in Pennsylvania. If not, a horse railroad should be built.[20]

The canal party of course took advantage of so tentative a position and argued that by the railroad advocates' own admission a locomotive railroad was too expensive for Pennsylvania, while a horse railroad was less efficient than a canal.[21] Consequently the railroad party was forced to defend the horse railroad and pointed to the long successful English experience

[14] "H," *U. S. Gazette,* December 12, 1825.

[15] "From the London magazine and review for January 1825," *National Gazette,* March 9, 1825.

[16] "Audi Alterem Partem," quoting the *Quart. Rev.* of March 1825, in *U. S. Gazette,* October 20, 1825.

[17] "From the London magazine and review for January 1825," *National Gazette,* March 9, 1825. See also, Strickland, *op. cit.,* 31. Railroad historians agree that the locomotive was a prerequisite for the general adoption of the railroad. See Haney, *op. cit.,* 63.

[18] In *U. S. Gazette,* February 24, 1825.

[19] See Pennsylvania Society . . . Acting Committee, *Internal improvement. Extracts from correspondence with William Strickland,* 2–4.

[20] *Facts and arguments,* 20–21, 52–54; "S" [the author of *Facts and arguments*], *U. S. Gazette,* September 6, 1825; *Internal improvement. Roads, canals, bridges, etc.* (the first edition of Facts and arguments), 9, 28n. He was far ahead of his time in this as in other respects; until shortly after 1830, stone construction was considered necessary for any permanence and for dense, heavy traffic. See Haney, *op. cit.,* 32–33.

[21] Carey, *Internal improvement—No. 2. Railroads and canals,* 3–4; "H," *U. S. Gazette,* September 5, 1825.

with it.[22] But almost all of this experience had limited relevance; specialized mine and quarry roads built in areas impossible for canals did not test the advantages of a general-purpose horse railroad over those of a canal. The railroad party must have believed that if it could obtain a horse railroad, a locomotive railroad would not be far behind. But in their eagerness to get any kind of railroad, they put themselves in a very weak public position, for they opposed Strickland's opinion that a railroad must be constructed for use by locomotives. As noted above, there was a good theoretical foundation for this opinion.[23]

Carey raised another objection to the locomotive; not only would it involve great construction expense but it would be "of little use, except on level roads, or those with very moderate ascents . . ."; therefore they were inapplicable to much of the mainline route. Then, by quoting Thomas Gray's well-known work on railroads: "a railway without a locomotive engine is like . . . a canal without water . . . ," he completed his syllogism and could triumphantly assert that the statements of the railroad advocates themselves had condemned the railroad, "particularly over the Allegheny, where the ascents are so numerous and so abrupt." [24]

It was true that the locomotive could negotiate only moderate inclines. Pennsylvania railroad enthusiasts claimed that the current English locomotives could take grades of sixty feet per mile, but Strickland reported that a line using a locomotive should not rise more than twenty-seven feet six inches per mile.[25] The problem of inclines had hindered the development of the general-purpose railroad in England for a decade or two. On the typical short mine railway leading to a waterway the incline was no problem—the cars were empty on the way up. But a railroad for general two-way traffic was evidently limited to relatively level areas if it used locomotives.[26] Why then had Strickland remarked in his first report on railroads that it was of little importance "whether the surface of the country be level or mountainous"?

The answer was provided in a report by the English engineer, William Jessop, an extract of which Strickland had included in his own report. Jessop agreed that as long as the railroad had simply followed the contours of the country, extensive use of the locomotive was out of the question. But in his opinion a recent construction improvement had solved the problem: long stretches of the road were made almost level by tunneling, cutting, and winding around hills. These could use the locomotives, while most of the rise and fall was handled by periodic inclined planes employing stationary engines.[27] Strickland defended this method in his correspondence with the Acting Committee of the Society. The "practical efficiency" of the locomotive and its superiority over horsepower on canals were fully proven, he contended, in the evidence presented before the committee of the House of Commons on the Liverpool and Manchester Railroad bill. He was certain that on the relatively level segments goods could be carried at a rate of six miles per hour with no more difficulty than on a canal at one-third the speed; while inclined planes and stationary engines with a lift of fifty feet in a thousand could be constructed for half the sum necessary to overcome the same elevation by canal locks. He conceded that these engines would require great skill and experience for maintenance and repairs, but contended that, firstly, the management and repair of canal locks and their sluices were almost as difficult; secondly, the extra power of the stationary steam engines would be available for manufacturing purposes—grinding grain, sawing timber, etc.[28] But the belief that the grade problem could be handled by the inclined-planes method was ignored by Carey and ridiculed by another opponent of railroads, until Carey himself proposed a railroad portage in January of 1826.[29]

The author of *Facts and Arguments* also advocated the inclined-planes method for Pennsylvania, but, as mentioned above, thought that horses might be used in the relatively level areas in order to reduce construction costs. He, therefore, felt it necessary to prove that the horse railroad was efficient on mild grades. His proof was simple: whatever the horse lost in speed and endurance while going up the incline would be made up for by the speed and ease of going down the other side. Canals, he pointed out, could not take advantage of this principle; descending boats did not just fall, they needed expensive locks to get them down. Here was the reason why "railways abound in the hilly districts of Great Britain," and why the nation of "Colombia" was about to construct a fifteen-mile railroad between La Guayra and Caracas with an ascent of 4,584 feet and a descent of 1,704 feet. It was this reasoning, evidently, that led him to make an extreme statement: ". . . mountainous districts

[22] "Examiner," *U. S. Gazette,* November 23, 1825.

[23] Pennsylvania Society . . . Acting Committee, *Internal improvement. Extracts from correspondence with William Strickland,* 2–4.

[24] *Internal improvement—No. 2. Railroads and canals,* 3–4. The work by Gray is *Observations on a general iron railroad,* 5th ed., London, 1825.

[25] "Examiner," *U. S. Gazette,* November 23, 1825; "Alnus," *U. S. Gazette,* November 11 and December 15, 1825; Strickland, *op. cit.,* 27.

[26] See Jackman, *op. cit.,* 2: 473.

[27] Strickland, *op. cit.,* 31–32.

[28] Pennsylvania Society . . . Acting Committee, *Internal improvement. Extracts from correspondence with William Strickland,* 2–4.

[29] "H," *U. S. Gazette,* September 5, 1825, ridiculed the method. Carey proposed the railroad portage in a "Letter to Alnus," signed "Hamilton," in *U. S. Gazette,* January 10, 1826. Carey, in his private pseudonymous capacity as debater, never mentioned Strickland's above-mentioned opinions; as chairman of the Society's Acting Committee, however, he published and signed the pamphlet that contained those opinions.

offer but very inconsiderable obstacles . . . and in many cases . . . they materially contribute to the success of railways. . . ." [30] He may have meant that mountains contribute to the advantage of railways over canals. But the harm was done. Carey sarcastically repeated this statement a number of times, adding only one or two well-placed exclamation points.

Related to the problem of surmounting grades was that of negotiating curves, for, to some extent, curves were a substitute for grades. The opponents of railroads had great difficulty in visualizing the behavior of a horse pulling a long train of cars around a series of curves:

> . . . in what possible way can he proceed, the most remote of the wagons being at so great a distance . . . behind him? The horse will by necessity direct his course one way, and the cars, being unavoidably confined to the rails, must move at right angle to it; or indeed frequently in a line directly the reverse. . . . Would not the friction of the wheels, upon the convex side of the rails, completely impede his progress? [31]

But on this question there was sufficient experience. The author of *Facts and Arguments* had visited England and had observed there that curves were easily negotiated even by long trains; on sharp curves the great friction on the inner track was relieved by means of friction wheels.[32]

Thus far we have dealt with the advantages—some of them disputable advantages—of the railroad: its greater geographic applicability, its speed, and its ability to handle mountains and sharp curves. The railroad also had one indisputable disadvantage: the use of tracks imposed a rigidity that did not exist on canals and roads; it was impossible for trains traveling at different speeds to pass one another any time they wished to do so. The canal party therefore contended that more than one set of tracks would be required for each direction and concluded from this that the cost of construction would be prohibitive.

This assumption was natural in view of the almost complete lack of English experience with the general-purpose railroad. Up to 1825, railways in England, with the sole exception of the early Surrey Railroad, had been specialized in the sense that they carried no passengers and only, or mainly, a single homogeneous commodity. Therefore, all trains ran at approximately the same speed. Furthermore, the company that owned the tracks also owned the cars and was therefore in a position to control speed and avoid delays. For the general-purpose railroads planned for 1825, however, railroad advocates took it for granted that most shippers would own and control the cars carrying their goods, as they did on canals and roads.[33] Indeed, to admit of any other possibility would probably have precluded the adoption of the railroad. For, on the basis of their experiences with roads, rivers, and canals, the taxpayers of Pennsylvania expected the right to put their cars on their railroad. To be forced to use the railroad's or some chartered company's cars would have been considered intolerable, for not only would the shipper be put to an extra expense; he would be at the mercy of a monopolist.[34]

Shippers would therefore retain ownership and control of the rolling stock. This made it imperative to keep the cost of such stock within the means of the small farmer and businessman. But this was unlikely. Strickland had noted in his report to the Society that the use of common carts on the railroad of the Duke of Portland in Ayreshire, Scotland, had ruined the tracks and concluded that, no matter what the disadvantages, specially constructed cars were a necessity.[35] Furthermore, the shipper would require a locomotive as well, or so it seemed. One anti-railway writer provided an example of the consequences. Settlers on the west branch of the Susquehanna River were mining bituminous coal. These men, he claimed could afford to build a canal boat holding twenty-five to thirty tons of coal; they could not afford the steam engine and the twelve or fifteen wagons that a railroad would require for the same load. Hence if a railroad were built, these settlers could not ship the coal, "or else the business must be conducted by chartered companies." [36]

The belief that the small shippers of Pennsylvania would be unable to use the railroad was reinforced by another consideration: the railroad, according to its opponents, was adapted only to trade between its extremities, not to local trade. For the latter would require constant stopping and starting, loading and unloading, all of which, given the inability to pass, could create nothing less than chaos. The charge was very serious; without local trade, the economic development of the interior of the state—that great accomplishment of the Erie Canal—would be out of the question. All

[30] *Facts and arguments*, 28–34; see also "S," *U. S. Gazette*, September 6, 1825.
[31] "H," *U. S. Gazette*, September 5, 1825.
[32] "S," *U. S. Gazette*, September 6, 1825.
[33] See *ibid.*
[34] See "H," *U. S. Gazette*, September 5, 1825. On the importance in the railroad's history of the "monopolist" charge against the common carrier, see Haney, *op. cit.*, 78, 81. Hartz, *op. cit.*, 69–81, 145–147, describes the popular attitude towards chartered companies and the consequent difficulties of administration on the Philadelphia-Columbia Railroad during the early 1830's.
[35] Strickland, *op. cit.*, 30–31. However, the flat-plate rails used on the Duke of Portland's railroad would have been more easily ruined than would edge rails. Haney, *op. cit.*, 83, notes that although it was generally assumed up to about 1830 that anyone might put his vehicle on the railway, B. H. Latrobe, in his 1808 letter to Gallatin, stated the necessity for specially-constructed carriages and considered this a serious limitation on the general use of railroads. For Latrobe's letter, see Gallatin, Albert, *Report of the secretary of the treasury on . . . public roads and canals*, 104–107, submitted to the Senate April 4, 1808, Washington 1808.
[36] "Philo-Hamilton," *U. S. Gazette*, November 12, 1825.

in the state would pay for a railroad, but only Philadelphia and Pittsburgh would gain from it.[37]

There was much justification therefore for the idea that a railroad would require multiple sets of tracks in each direction. Carey remarked that within the space of a mile or two on the Pittsburgh Pike he often saw thirty to fifty wagons, some loaded and slow, others empty and faster; intermixed with these were the speedier stage coaches and the even faster pleasure carriages. He imagined these all strung out on a single railroad line with none capable of passing, and evoked a picture of chaos that reminds one of the modern traffic jam. Hence Carey was certain that two or three pairs of tracks for each direction would be a necessity. This explained, he claimed, the cost estimate of $54,000 per mile on the Liverpool and Manchester Railroad. "There is no other way of accounting for the expense." [38]

Carey must have known better. As his opponent "Examiner" pointed out, the high cost of the Liverpool and Manchester included the cost of cars, locomotives, stationary engines, warehouses, expenses of litigation, and, above all, the enormous cost of land in the industrial center of the workshop of the world.[39] Furthermore, Strickland had explained to the Society that on single railroads periodic sidings allowed passing; on double railroads switches were used. He believed that these methods solved the problem.[40] The English opinion was that 250- to 300-foot sidings every half mile were an adequate solution. As railroad advocates in Pennsylvania pointed out, this was their solution not only on the existing specialized railroads but also in their current plans for general-purpose railroads. Indeed, these defenders of the railroad were infuriated at the idea of treating the problem of differential speeds as a disadvantage of the railroad. After all, the problem arose because the railroad liberated mankind from that miserable canal speed of two to four miles per hour.[41]

Experience was to show that the common-carrier method was the only possible way of handling a fully developed traffic on a modern general-purpose railroad. But in 1825 there was little reason to doubt—and in fact there was no doubt in England—that the passing problem could be handled by either periodic sidings or switches. Carey never so much as mentioned these generally-accepted solutions to the problem.

[37] See "H," *U. S. Gazette,* September 5, 1825.

[38] *Internal improvement—No. 2. Railways and canals,* 4. See also "Philo-Hamilton," *U. S. Gazette,* November 11, 1825; and "H," *U. S. Gazette,* September 5, 1825.

[39] *U. S. Gazette,* November 23, 1825.

[40] Strickland, *op. cit.,* 25; Pennsylvania Society . . . Acting Committee, *Internal improvements. Extracts from correspondence with William Strickland,* 2–4.

[41] See "S," *U. S. Gazette,* September 6, 1825; "Examiner," *U. S. Gazette,* November 23 and December 12, 1825; "Alnus," *U. S. Gazette,* January 3, 1826.

MODE OF CONSTRUCTION OF RAILROADS

That the railroad would consist of two pairs of tracks and periodic sidings was accepted by all in the railroad party. But there were other problems that could seriously affect costs. One of the most important of these involved the type of rail to be used. Here the author of *Facts and Arguments* was on firm ground. Like Strickland, he thoroughly understood the importance of that crucial invention, the edge rail. In 1789 William Jessop had replaced the 4-inch-wide flatbar rail with a 1½-inch-thick iron bar placed on its edge, and had transferred the flange from rail to wheel.[42] The advantages, as *Facts and Arguments* accurately described them, were enormous. First and foremost, the edge rail decreased surface friction as well as obstruction by the sand and stones that had formerly adhered to the angle between the rail and the flange. According to John Stevens, a horse on the Surrey railroad, on whose flat-bar rails the inevitable furrows had developed, could draw only 9,000 pounds; on the edge railway near New Castle a horse drew 25,500 pounds. Furthermore, a smaller amount of iron—an expensive commodity in the United States—provided a much greater resistance to breakage. Consequently, the author of *Facts and Arguments* could assert that cost and profit estimates based on the entire British experience seriously underestimated the advantages of the railroad because most British railroads had been constructed with flatbar rails.[43]

The type of roadbed required was another construction issue with important effects on estimated cost. One writer attacked the cost estimates in *Facts and Arguments* on the ground that a road able to bear rails, cars, and a horse would have to be at least the equivalent of a well-constructed turnpike. *Facts and Arguments* itself estimated the average cost of the best turnpikes in America at $9,000 to $12,000 per mile. To this cost would have to be added the cost of the railroad itself. Clearly the cost estimates in *Facts and Arguments,* which ranged up to a maximum of $10,000 per mile, were too optimistic.[44] According to the author of *Facts and Arguments,* however, the roadbed would have to be little more than a path. The railroad would rest on short wooden piers; the road below

> "is covered with coarse gravel, etc., to a depth of three inches only. . . . *Deep* cutting and *heavy* embankments will be entirely unnecessary. The bridges are extremely simple. . . . A horse-path on a canal can be constructed for less than two hundred dollars per mile, and it does not differ from the path used on a railway." [45]

[42] Jackman, *op. cit.* 2: 465.

[43] *Facts and arguments,* 18–19; "Audi Alterem Partem" (John Stevens), *U. S. Gazette,* October 15, 1825.

[44] "H," *U. S. Gazette,* September 5, 1825. See also the report of the speech by "Mr. Tweed" at the Harrisburg Convention in *U. S. Gazette,* August 12, 1825.

[45] "S," *U. S. Gazette,* September 6, 1825. The assumption that the tracks had to rest on vertical piers was general until after 1830; see Haney, *op. cit.,* 32.

Another construction issue involved the method of crossing ordinary roads. Canal advocates suggested that since the railroad would be above any common road, bridges would be expensive affairs. Railroad advocates replied that bridges over canals were even more expensive and that the railroad could use the method of a beam turning on a pivot (presumably, the method of a turn-bridge).[46] Strickland, however, did not assume that the railroad had to be above the ground, and reported that crossing a road could be accomplished simply by imbedding the tracks slightly under the surface of the road so as to protect them from the wheels of common wagons.[47]

CONSTRUCTION COSTS

The required mode of construction of railroads was but one aspect of the extremely complicated issue of construction costs. On this point everyone was in the dark but no one would admit it. British railway costs were quoted, rebutted, and quoted again, but even if the combatants had agreed as to the British statistics, they could have debated endlessly on their applicability to the very different cost and construction conditions in the United States.

According to the author of *Facts and Arguments,* the cost of double-tracked "wooden railways guarded with iron bars" would be $7,000 per mile in relatively flat country, $8,600 per mile in undulating areas. In contrast, the average canal built for 45-ton boats cost, according to the same author, $18,000 to $20,000 per mile if the terrain were favorable; tunnels, locks, and rock excavation could double the expense. But the true cost advantage of the railroad, the author added, was even greater than that shown by per-mile comparisons. Because of the necessity to find water, canals tended to be much longer than railroads between any two terminals; and because canal construction took three times as long as railroad construction, the interest charge was correspondingly heavier. The Erie Canal, he stressed, cost $22,300 per mile, exclusive of interest.[48]

He proceeded to apply these considerations to Pennsylvania. The canal proposed by the Canal Commissioners—along the Juniata, Conemaugh, and Allegheny rivers—would require, by their own admission, 3,358 feet of lockage and a four-mile tunnel. The Commissioners thought the entire project could be completed in six years; he estimated five years for the canal and an additional five years for the tunnel. The Commissioners estimated the total cost at $3 million; he was certain it would cost at least $7 million and probably double that amount in view of the fact that the Erie, with 655 feet of lockage and no tunnel, cost $7 million plus interest. He emphasized that the canal proposed by the Commissioners would have at least five hundred locks, despite the tunnel; the Erie Canal had ninety.

The railroad proposed by the author of *Facts and Arguments,* on the other hand, would require neither tunnels nor aqueducts; it could use the existing bridges on the Susquehanna; and it could be completed, he thought, in two or three years. He admitted that, for lack of railroad surveys, there was no basis for accurate cost estimates. But "from data already in our possession" he estimated the cost of a 300-mile Philadelphia-to-Pittsburgh double-tracked horse railway using edge rails at $10,000 per mile, $3 million for the entire railroad. The four rails, he suggested, would rest on horizontal wooden beams which in turn would rest on three parallel ranges of wooden piers. If it turned out that wooden piers could support the weight of a locomotive, then, he believed, Pennsylvania should build a railroad adapted to both horse and locomotive, for the cost would not be much greater than for horse alone.[49]

Carey's initial attack upon the cost estimates in *Facts and Arguments* depended exclusively on the British cost experience. He estimated the number of canals more than five miles long in Great Britain and Ireland at approximately one hundred. Choosing fifty-three of these (some of which included tunnels), he found that their average cost per mile was 4,439 pounds ($18,975.50). On the other hand, "all writers on railways in England, entitled to credit" estimated the cost

[46] "H," *U. S. Gazette,* September 5, 1825; "S," *U. S. Gazette,* September 6, 1825.

[47] Strickland, *Reports,* 27.

[48] *Facts and arguments,* 31–32. A contemporary British advocate of railroads, less optimistic, placed the cost of a double railroad at 3,000 to 5,000 pounds sterling ($13,500 to $22,500) per mile (article reprinted from *The Scotsman, Amer. Mechanics' Mag.* 1: 147–149, 163–166, 180–184, New York, April 1825). Strickland estimated the cost in England of a mile of single-tracked railroad containing sidings, a wooden bridge, and stone foundations, at 2,108 pounds sterling ($9,486). This included 80 pounds ($360) for the cost of land (*Reports,* 30). In the Congressional debate of 1831–1832 it was generally admitted—though sometimes disputed by canal companies—that railroads were cheaper to construct and could be built more quickly than canals. See Haney, *op. cit.* 59. On the other hand, George R. Taylor notes that in practice canal costs turned out to be lower, on the average. Per-mile costs of canals were usually between $20,000 and $30,000, although some were much higher—$60,000 for the Chesapeake and Ohio, $80,000 for the Susquehanna and Tidewater, for example. In comparison, of the short railroad lines built across New York State that were later combined to form the New York Central, three cost less than $30,000 per mile, five cost more. The too-solidly-built Boston and Lowell Railroad cost $71,000 per mile; the Baltimore and Ohio, $54,000 per mile; the Georgia Railroad, only $17,000 per mile. See Taylor, *Transportation revolution,* 53–54.

[49] *Facts and arguments,* 47–49, 51–54; "S," (the author of *Facts and arguments*), in *U. S. Gazette,* September 6, 1825. Some of his figures are not quite accurate. The amount of lockage on the mainline, as estimated by the Canal Commissioners in their report of February, 1825, was 2,595 feet from the Susquehanna to Pittsburgh. To this, the author evidently added the Commissioners' estimate of 741 feet of lockage on the larger, more direct canal that would eventually have to replace the Union Canal, making a total lockage of 3,336 feet. The Erie Canal had 84 locks and a lockage of 689 feet.

per mile of a double-tracked railroad at 5,000 pounds ($22,500).[50] Carey admitted that some items would cost less in America. He further admitted that a railway might be constructed in half the time required by a canal, thus saving interest charges. But these savings, he claimed, would be counterbalanced by the higher level of wages in America.[51]

Carey had difficulty defending his sample of fifty-three English canals. He admitted in a subsequent article that they were the low-cost canals, that the twenty-two high-cost ones were on the average more than three times as expensive as those in his sample—13,800 pounds ($62,100) per mile. But "these last were for ship navigation, or have an extraordinary amount of tunneling, or were liable to various difficulties, and of course are not to be taken into consideration in making an estimate of a canal under ordinary circumstances."[52] He evidently considered a Pennsylvania canal in the low-cost "ordinary" category.

Carey admitted, however, that the cost of British canals was not the best type of evidence; there was after all some American experience to draw upon. His November and December pamphlets therefore contained another set of cost comparisons. He began by listing the average per-mile construction costs of the major American canals: $22,500 for the Erie and Champlain, $22,500 for the Merrimack, $20,000 for the Schuylkill, $13,000 for the forty-mile section of the Union Canal so far completed, and an estimated $10,000 for the projected Ohio Canal. Let us take the extremely generous estimate of $20,000 per mile, Carey suggested. Then the cost of a Pennsylvania canal from the Susquehanna to the Ohio, exclusive of a twenty- to thirty-mile portage, was not the $10 million to $15 million estimated by the railroad propagandists but a mere $5,400,000. Furthermore, on the basis of the Erie Canal's experience—eight years for construction—the shorter Pennsylvania Canal could be built in five and a quarter years.[53]

Another pro-canal estimate was published in September by the Committee of the Harrisburg Convention. The Committee thought that a full canal from the Susquehanna to Pittsburgh, including a tunnel and using wooden locks, would cost $4 million. For the entire Philadelphia-to-Pittsburgh canal, using stone locks, they thought that $8 million would be an extremely generous estimate "(but we believe it $1,500,000 too much)," and that eight years would be required to complete it. However, in view of the imminent completion of the Union Canal, only a Susquehanna-to-Pittsburgh canal was recommended for the time being.[54] These estimates were an improvement on the February, 1825, Canal Commissioners' estimate of $3 million for the Susquehanna-to-Pittsburgh canal *cum* tunnel, but they were not much of an improvement.

For the comparable railroad costs, Carey had to return to England. He took two examples. The thirty-mile double-tracked railroad from Cromford to the Peak Forest cost 4,966 pounds ($22,347) per mile. But this was for only two pairs of tracks. Carey contended that at least two pairs would be required for each direction to accommodate cars of different speeds. The (imported) iron alone for these eight tracks would cost, he thought, $12,600 per mile.[55] For his second example, Carey took the cost of the recently opened Stockton and Darlington Railroad which had a double set of tracks with periodic sidings. Its cost of 3,000 pounds ($13,500) per mile he contrasted with the maximum estimate in *Facts and Arguments* of $10,000 per mile for a double-tracked Pennsylvania railroad.[56]

The railway's defenders struck back by undermining Carey's statistics—a not too difficult task. Their favorite target was his peculiar method of averaging the cost of carefully selected low-cost canals for comparison with high-cost railroads; and their favorite statistical ammunition came from an authoritative article in the *London Quarterly Review* of March, 1825, that estimated the average per-mile cost of canals in Great Britain at 9,000 pounds ($40,500), and of railroads at 5,000 pounds ($22,500).[57]

But it was not only the biased statistics that bothered Carey's opponents. They charged that he had also distorted or suppressed vital related facts. For example, he had cited the cost of the completed section of the Union Canal—$13,000 per mile—but had neglected to mention the fact that this canal was limited to boats of up to twenty-five tons and not more than eight feet wide, hence its dimensions were entirely too small to serve as part of an interregional waterway. Even canal advocates were anxious about the dimensions of this eastern extension of the mainline canal because it would force transshipment from the larger boats to be used on the main route. Another fact that

[50] *Internal improvement—No. 1. Railways and canals,* 3–5.

[51] *Internal improvement—No. 2. Railways and canals,* 2–3.

[52] *Internal improvement—No. 3. Railways and canals,* 2. Carey stated that his figures were drawn from a single work: *Des canaux navigables* by Huerne de Pommeuse, Paris, 1823. Railroad advocates demonstrated that the Pommeuse figures were remarkably untrustworthy by comparing them with London price lists. See "Alnus," *U. S. Gazette,* November 11, 1825; and "Examiner," *U. S. Gazette,* November 23, 1825. "Examiner" estimated the average cost per mile of all British canals at 12,000 pounds ($54,000).

[53] *Internal improvement—No. 3. Railways and canals,* 4–5; *Internal improvement—No. 4. Railways and canals,* 2. Carey did not specify in this connection the type of portage—rail, road, or both—or its cost.

[54] *Address to the citizens of Pennsylvania on the subject of internal improvements, by a committee appointed by the convention,* 5, 5n, n.p., n.d., dated August 22, 1825.

[55] *Internal improvement—No. 3. Railways and canals,* 4.

[56] *Internal improvement—No. 5. Railways and canals,* 4.

[57] "Audi Alterem Partem," *U. S. Gazette,* October 20, 1825; "Alnus," *U. S. Gazette,* December 15, 1825; "S," *U. S. Gazette,* September 6, 1825; "Examiner," *U. S. Gazette,* December 12, 1825.

Carey omitted was that the Union Canal would be seventy-four miles long, whereas the extremities it connected were forty-five miles apart as the crow flies.[58]

The international comparisons raised further difficulties. As an opponent pointed out, Carey blandly ignored the great differences in land costs when comparing American canals and English railroads. Furthermore, he ignored the possibilities of adaptation of English methods to American conditions. His estimate of the cost of iron needed by a mile of railroad, for example, was based on the British practice of using heavy rails. American railroads, according to Carey's opponent, would use wooden tracks plated with a wrought-iron bar placed on its edge. This kind of adaptation had already occurred in bridge construction: Americans used their inexpensive wood where Englishmen used stone and iron. Railroad advocates believed there would be many opportunities to do the same on railroads.[59]

Nevertheless, granting the greatest possible use of wood, a railroad would still require iron in quantities never before demanded in the United States. The price of iron, high enough before, could easily skyrocket; importation of British iron would be a necessity. Strickland had confirmed these fears in his correspondence with the Society's Acting Committee; it was a serious consideration in any cost estimate. But this was not the end of the matter for the Pennsylvania railroad advocates. They predicted that this unprecedented demand would enormously stimulate the domestic iron industry. The great Philadelphia-to-Pittsburgh railroad would first create this immensely beneficial state industry and then transport its products cheaply throughout the state and to the west. The railroad's massive iron requirements were nothing but a blessing in disguise.[60] However, a writer on the canal side, one who also looked forward to the development of a domestic iron industry, favored a more cautious approach. "Bring out our resources by the construction of Canals," he wrote; cheap transportation would certainly increase domestic iron production and reduce its price. Later, when "rail-ways are found practicable and necessary to *aid* our canals, we may then construct them with prudence." [61]

OPERATION AND REPAIR

Another set of issues centered on problems of operation, maintenance, and repair of railroads as compared to canals, and the effects of all these upon shipping costs. For example, canal advocates asserted that a horse could draw fourteen tons on a railroad, twenty-five on a canal. Railroad enthusiasts answered that the principal expense in drawing a canal boat was the wages of the boatmen—a man and a boy on the boat and sometimes a man with the horse. On a railroad, "one superintendent can manage seven horses." Furthermore, the horse would go faster. Consequently, the wage cost of hauling a given load was far less by horse railroad than by canal, and this differential would increase when locomotives were used.[62]

The defenders of the railroad were in a particularly fortunate position on this issue. The recently opened Stockton and Darlington Railroad provided the first definitive evidence of the marvelous operational capacity of the locomotive railroad, and enthusiasts could hardly contain their emotions in describing it:

> At the opening of the Stockton and Darlington railroad, thirteen wagons loaded with two tons of coal or flour *each* and *five hundred and fifty-three* passengers (making in all at least sixty-six tons exclusive of engines or wagons) was attached to an eight horse steam engine, or as they call it the "Iron horse"; the whole of this immense train was drawn up an inclined plane of 3000 yards long in *eight minutes,* being nearly at the rate of *thirteen miles an hour.* . . . Does not this appear almost like a tale taken from Sinbad the Sailor? Yet it happened only about three months ago, and was witnessed by between 40 and 50,000 spectators!! Dr. Darwin little thought how soon his prophecies would come true.
>
> "Soon shall thy arm unconquered steam, afar
> "*Drag* the slow barge, or *drive* the rapid car,
> "Or on wide waving wings, expanded bear
> "The flying chariot, through the fields of air." [63]

But canallers remained unmoved. Concentrating on that easy mark, the horse railroad, they disputed the railroad enthusiasts' figures. Each horse on a railroad, one writer insisted, would require a man to guide it and would draw only six tons. Furthermore, canals could sometimes use the wind as motive power; a railroad could not. This consideration was particularly important, according to one canal advocate, because the heavier freight would pass from west to east on a Pennsylvania canal, while for two-thirds of the year the prevailing winds were also from the west.[64]

Then there was the issue of the relative cost of repairs on railroad and canal. Carey took Tredgold's figure for annual repairs and toll-collecting expenses on a railroad—$630 per mile—and triumphantly compared it with the corresponding expense on the Erie and Champlain canals—$225 per mile.[65] But an equally triumphant railroad advocate pointed to another asser-

[58] "Examiner," *U. S. Gazette,* November 23 and December 12, 1825.

[59] *Ibid.,* November 23, 1825.

[60] *Facts and arguments,* 152; "Alnus," *U. S. Gazette,* December 15, 1825.

[61] "Tweed," *U. S. Gazette,* August 30, 1825.

[62] *Facts and arguments,* 36–38. See also "S," *U. S. Gazette,* September 6, 1825.

[63] "Alnus," *U. S. Gazette,* December 15, 1825.

[64] "Northumberland," *U. S. Gazette,* September 22, 1825; "H," *U. S. Gazette,* September 5, 1825. In 1830, sails were actually fitted to a car on the Baltimore and Ohio Railroad. For an account of the experiment, see Hungerford, Edward, *The story of the Baltimore and Ohio railroad, 1827–1927* 1: 80, New York, G. P. Putnam's Sons, 1928.

[65] *Internal improvement—No. 2. Railways and canals,* 3.

tion by the same great authority: in England the expenses of repair and superintendance were much greater on canals than on railroads.[66] There the matter stood, except for the question of time. Repairs on canal locks took months and could seldom be accomplished in the winter; repair of a section of a railroad "would never require more than a few hours," according to its defenders.[67]

THE PORTAGE ISSUE

How are we to evaluate the effect of these technical issues upon the debate? Did Pennsylvania reject the railroad in 1826 because of its technical impracticability at that time? To throw some light on this question we turn to the problem of the portage over the mountains, for in this limited area there were canal advocates who actually proposed a railroad.

The proposal, it is true, was not an enthusiastic one. Despite some previous hints, Carey did not admit the necessity of a portage until December, 1825, and did not admit the possibility of a railroad portage until January, 1826. Even then he left the issue in conditional form—a railroad portage "could" be used, he wrote—and the February, 1826, decision avoided the issue entirely by authorizing only certain canal segments. Nevertheless, it was generally realized during the debate that a tunnel was out of the question; and if the portage were a mere common road, Pennsylvania could not hope to compete successfully with its neighbors' projects. Mainline leaders were, therefore, forced to accept the auxiliary railroad despite all their technical arguments agains the full railroad.[68]

There were some technical considerations advanced by railroad advocates that may have been used to justify acceptance of railroads over mountains simultaneously with rejection of railroads in relatively level areas. According to a respected railroad authority much quoted by Carey, Thomas Tredgold, in any area construction cost and annual repairs on a canal exceeded those on a railroad. But in relatively level areas the greater hauling power of a horse on a canal—when its speed was no greater than three miles per hour—more than compensated for the higher capital costs. In mountainous areas, on the other hand, the expense and delays required by large numbers of locks gave the advantage, Tredgold thought, to a railway using inclined planes with stationary engines or horses.[69] This differential effect of grades was, of course, but one aspect of the comparison of railroad and canal; there was also the greater speed on railroads, the all-weather use, etc. But there was at least some small technical basis for the peculiar mongrel-line solution to the mainliners' problems.

Nevertheless, acceptance of the portage railroad did directly contradict a number of the technical arguments that canallers had advanced against the full railroad. A full railroad would need several sets of tracks, they thought, but the portage railroad would need but two. The severe American frosts would break up the tracks of railroads in general, but not of a portage railroad in a high mountain area. That locomotives could not be used on steep inclines was considered a serious objection to the railroad, but the portage railroad could use to good effect the system used in England for entire railroad lines and recommended by Strickland, that is, locomotives on relatively level areas and stationary engines on inclined planes. What important argument was left then? Only Carey's construction cost estimates, which tried to prove merely that the railroad's cost was approximately on the same level as that of the canal.

We must conclude that technical factors alone cannot account for the rejection of the railroad. Indeed, that Strickland—a capable, objective engineer with the best possible opportunities for observation—favored the railroad for Pennsylvania in 1825 is alone sufficient evidence for this conclusion. True, there were many attributes of the railroad yet to be tested; this spoke in favor of a postponement of the project. But there was no definitive technical reason to reject the railroad and build a canal. We must turn elsewhere to discover the causes of the decision of 1826.

THE EXPERIENCE ISSUE

Building a railroad meant taking a chance, whereas building a canal meant certainty of success; this was the main burden of the canal party's argument. Its proof rested on two simple propositions: canals both in England and in the United States had a record of successful achievement; railroads did not. We turn now to these arguments from experience.

THE ANALOGY WITH THE ERIE CANAL

The most impressive evidence for the canal method, Carey contended, was the dividend record of the English canal companies and the obvious success of the Erie Canal. From his observations of both phenomena, but particularly of the Erie, he concluded that if a canal were carefully located; if it had a full supply of water; if it passed through areas with extensive traffic, especially at each extremity; and if the area possessed, as did Pennsylvania, minerals like coal, iron, salt, and limestone; then it "can never fail to produce transcendent advantages."[70] Carey here ignored Pennsylvania's geographic problem, but the *United States Gazette* was willing to grant all the advantages that the anti-mainliners claimed for New York—"'*circumstances,* fea-

[66] "Examiner," *U. S. Gazette,* November 23, 1825.

[67] "Alnus," *U. S. Gazette,* December 15, 1825.

[68] For the development of the mainline leaders' views on the portage, and the evidence for the above statements, see below, p. 53.

[69] Tredgold, *op. cit.,* 9–10.

[70] *Internal improvement. New series* 1: 4.

tures of the country, and natural capacities for business.'" Nevertheless, "enough would be left to induce Pennsylvania to put forth her *whole* energies. . . ." [71] The argument here was by analogy: since the two canals were essentially the same, and since the Erie's success was so great, the Pennsylvania canal was bound to be a success too, even if a lesser success. Consequently, the danger to Pennsylvania lay in adopting some other means than a canal or in passivity. The failure of an active canal policy was inconceivable. "Why neglect the present moment?" asked a mainliner. "Is it because there is danger of public or state loss? . . . the collection of tolls last year, on the Erie Canal is a refutation of such an allegation." [72] Or, as the *United States Gazette* rhetorically inquired, ". . . how can we *know* anything more to the point of the argument in favor of canals in Pennsylvania, than their success in an adjoining state?" [73]

This remarkable faith in the power of a questionable analogy only increased with time. As late as 1831, when Pennsylvania was in financial difficulties, Carey could still assure Pennsylvanians that the tolls of the mainline would defray all expenses, pay interest regularly, create a sinking fund to pay off the debt in fifteen or twenty years, and then furnish the government with a fund for the support of education and for the further extension of improvements. "Such events are as certain as any events in the womb of time. The situation of the canal funds of New York . . . removes all doubts on this subject. . . ." [74]

In the same 1831 pamphlet, Carey complained that the method of financing the mainline was unsound and partly responsible for Pennsylvania's financial difficulties. That method was adopted, not only because of a general reluctance to pay taxes, but also because of a vast overestimation of the returns from the mainline. So convincing was the Erie Canal analogy, that all taxes imposed prior to 1844 were limited in operation to five years because, by then, the canal would support the government.[75]

The pro-canal argument thus far described depended entirely upon the use of a remarkably weak analogy. The following statement of a railroad advocate indicates how easily that analogy could, seemingly, be destroyed during the debate:

> The Erie Canal traverses a most remarkable country, extremely favorable to the construction of a canal. . . . The Pennsylvania canal will be the reverse. . . . The Erie Canal has no tunnels; ours will have at least three; one of them about four miles in length; and 750 feet below the summit of the mountain! . . . The Erie canal has no very *large* aqueducts . . . [ours will have, among others] two of immense height between Philadelphia and Lancaster, and one of enormous length over the Susquehanna. . . . The locks on our canal will be 500 in number; on the Erie canal the number is not 1/5 of the above. The lockage to be overcome on our route is 3358 feet. On the New York canal the ascents and descents do not exceed 655 feet.[76]

Having rung all the changes on these great disadvantages that nature had imposed upon Pennsylvania, the railroad advocates could then contrast the Erie Canal's cost of $23,100 per mile with the truly fantastic estimates of $10,000 to $15,000 per mile put forward by those in the canal party.[77] It seems as if the very first touch of serious analysis should have shaken the analogical argument: "Pray, is there a canal existing, or ever did exist whose elevation is 1831 feet above the sea . . . ?" [78]

But the very effectiveness of the railroad party's attack poses a problem. How could the responsible leaders of the mainline movement continue to proclaim themselves so certain of the success of a canal when the analogy was so obviously weak? The answer is that there was an aspect of the analogical argument that the railroad advocates' attack did not touch, one that was, in fact, impervious to any attack. The railroad party could easily prove that, in view of Pennsylvania's enormous geographic disadvantages, a Pennsylvania canal could be a financial failure despite the Erie Canal's financial success. For the canallers, however, the effectiveness of the Erie Canal's example did not depend upon a demonstration that a Pennsylvania canal would be equally profitable. True, they often claimed the prospect of equal or greater success for Pennsylvania. But they also demonstrated, on the basis of the Erie Canal experience, that even a Pennsylvania canal that was a financial failure would nevertheless be a tremendous success. For there was an aspect of the Erie Canal's success that was not necessarily reflected in those astounding toll receipts: the Erie Canal was responsible for the economic development of entire regions. In many areas of western New York, according to the Acting Committee of the Society, towns were springing up on the banks of the canal "as if by magic." Villages, formerly languishing, had doubled their population within three or four years. "In fine, there has rarely been a greater addi-

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[71] October 18, 1825.

[72] "Bridgewater," *U. S. Gazette,* March 11, 1825.

[73] Editorial, October 18, 1825.

[74] *Brief view of the system of internal improvement of the state of Pennsylvania,* iv–v, 23, Philadelphia, 1831.

[75] See Bishop, *op. cit.,* 205–208, 226. The act of April 1, 1826, provided for establishment of an internal improvement fund whose principal sources, aside from future appropriations and tolls on the completed works, were to be $30,000 from the auction duties, the net proceeds of escheats, and the dividends accruing from the canal, road, and bridge stock owned by the state. According to Bishop, these could be expected to yield $60,000 per year, sufficient to pay the prevailing rate of interest (five per cent) upon loans amounting to only $1,200,000.

[76] "Examiner," *U. S. Gazette,* December 12, 1825. In his *Internal improvement—No. 4. Railways and canals,* 1, Carey refers to "The Examiner, who is the author of *Facts and arguments. . . .*"

[77] See "Alnus," *U. S. Gazette,* December 30, 1825.

[78] *Ibid.*

tion to the sum of human happiness and prosperity in the same space of time. . . ." [79]

The implications for Pennsylvania were spelled out in the *Address* of the Committee appointed by the Harrisburg Convention. Beginning as usual with the size of the Erie's tolls, which proved that a Pennsylvania canal would not only pay off the debt but also support the government, the Committee proceeded to other factors of an even more important nature. Access to market would stimulate industry; remote areas would develop their agriculture and minerals; as in the neighborhood of the Erie Canal, swamps would be cleared, marshes drained, and towns would spring up; like their New York counterparts, Pennsylvania farmers near the route of the canal, currently deeply in debt, would prosper, and the value of their land would rise, probably by an amount beyond the entire expense of the canal; sources of government funds would increase: auction duties, retail sales of foreign articles, licenses—especially tavern licenses. The resources of the state, the Committee predicted, would be twice their present amount on completion of the canal and three times afterwards.

To these long-run considerations the Committee added certain equally inevitable short-run benefits. While the construction work was in progress, millions of dollars would be spent, not in some foreign area, but right there in Pennsylvania; "the expenditures . . . will be distributed among ourselves. . . ." The more than six thousand workers to be engaged would buy the farmers' produce and rent his horses and oxen. And then, when the canal was completed, "the era of general and extensive prosperity" would begin.

Benefits, the Committee asserted, cannot be measured by revenue alone. If Pennsylvania's turnpikes and bridges were destroyed it would be worth twice their cost to restore them, for they enhanced three-fold the possessions of the farmer and they gave industry a market, and this was so even though there was little pecuniary gain to those who created these benefits, whether state or individual. "Such have been the effects of turnpikes in Pennsylvania, and how much greater would be the effects of canals." [80]

With the argument totally independent of the expected toll yield, the analogy with the Erie Canal was applicable whatever the geographic disadvantages of Pennsylvania. In that 1831 pamphlet, written at a time when public confidence in the ultimate profitability of the mainline was beginning to wane, Carey's assertion that the profits would be enormous because the Erie's profits were enormous was supplemented by the argument that the 1826 decision was correct even if it turned out that the tolls were sufficient merely to keep the improvements in repair and pay the collection expenses. The problem, he explained, could be considered from two distinct points of view:

> . . . the one as regards the interest to be derived on the capital invested, a consideration befitting a mere merchant, or trader, or capitalist—the other, incomparably more important, has regard to its effect on the happiness, the independence, and the comfort of our citizens—the general prosperity of the state, and the increase of its population. . . . These are the views to be taken by statesmen worthy of being intrusted with the destiny of nations.[81]

The great power of this argument was fully demonstrated when the mainline was not only an utter failure but also had demonstrably failed to attract the trade of the west. As late as 1845 a writer in *Hunt's Merchants' Magazine* panegyrized the mainline on this ground, insisting that even if the mainline never yielded a penny above annual expenses, the people of Pennsylvania would still have gained because of the increase in property values, the development of resources, the attraction of capital and population to the state, "the enterprise awakened, and dormant energies aroused," the increased price of everything sent to market, and the reduced prices of products from the seaboard. All there were worth many times more to the population that the amount of state taxes required by the canal.[82]

How could the railroad advocates demonstrate that the total gain, direct and indirect, of a great project would not justify the cost? It was hardly an easy task in the 1820's—nor would it be in the 1960's! The author of *Facts and Arguments,* however, simply resorted to the fundamentals of early-nineteenth-century economic theory. "In these labour saving machines"—that is, roads, canals, railroads, bridges, steam and other engines—"if more labour (or what is equivalent, money) is expended in their erection, than can be saved by their assistance, the sound dictates of political economy would forbid their adoption. . . ." This principle had been greatly neglected: "Capital, which otherwise would have been employed in agriculture, commerce or manufactures, and have produced the usual returns of interest, have been squandered. . . ."

But stating the principle was not enough. How was the "labour" saved by a project to be measured? The measure, he thought, should be the average rate of interest earned by the capital invested. If the tolls on the project could not yield that amount, "it may be pronounced a misapplication of enterprize." However, there was no need for a government actually to collect that amount in tolls. The criterion was merely the possibility of collecting it. He was willing to admit of

[79] "To the citizens . . ." in *U. S. Gazette,* March 22, 1825.

[80] Pp. 2–7. The same distinction between public and private benefit was made in an editorial in *U. S. Gazette,* October 18, 1825; and by the Acting Committee of the Pennsylvania Society in "To the citizens . . . ," *U. S. Gazette,* March 22, 1825. For the influence of the "economic development" argument on Pennsylvania's entire internal improvement program in the period 1826–1834, see Segal, *op. cit.,* 134.

[81] *Brief view . . . ,* 20.

[82] Strong, *op. cit.* 13: 138.

only one exception: war might justify projects otherwise unjustified.[83]

Thus, confronted with Carey's choice between the businessman's and the statesman's point of view, the railroad advocates took a stand between the two. They did not require an actual toll gate producing actual profits, but they assumed that the total advantage of the project—the total effects of its stimulation to industry, mining, and agriculture, and the effects of towns springing up "as if by magic"—would be measured by receipts at a toll gate if it were so desired. For the supposed theorists, visionaries, radicals of the debate, this was a remarkably conservative criterion. Indeed it was too conservative for any internal improvement movement and was bound to be rejected. Its application would have prevented the building of many of Pennsylvania's turnpikes and bridges. Nor could the criterion carry conviction. Nowhere did the railroaders explain how it came about that all benefits could be measured by toll gates.

At first sight, the economic development argument seems neutral as between railroad and canal. All it proved was that the tolls were not necessarily a measure of the total benefits. But the canal advocates carried it further; they converted it into the argument that all interregional transportation projects like the Erie Canal confer immeasurable benefits. (Without the toll gate as a criterion they were actually unmeasurable.) The temptation was strong, then, to drop all the complex technical criteria described above. If a canal would inevitably yield spectacular benefits (in spite of disadvantages that might reduce or eliminate financial profit), it hardly mattered that a railroad might yield more than a canal. Advantages in speed, year-round operation, even costs became minor considerations. Indeed every ordinary criterion of choice became irrelevant and only the criterion of certainty remained. As a bitter railroad advocate put the position of his opponents, "some supinely say—'why try a *probable* better, when we have a *certain* good . . . ,'" [84] and as a canal advocate put it, building a railroad meant "relinquishing a certainty for an uncertainty." [85]

Curiously, no one contrasted this single criterion with the criteria used by New York in its decision to build the Erie. Carey, for example, in contending that a Pennsylvania canal could be built in a shorter time than the Erie had required, described the enormous difficulties the builders of the Erie had faced: nearly all of them had lacked any experience in canal construction and had been forced to rely on books that were "lamentably deficient" on the subject.[86] In another article he referred to the Erie Canal as a "stupendous undertaking" warranting great apprehensions on the part of its projectors, and as a "hazardous experiment" requiring "iron nerves." Could Pennsylvania, he asked, be so unworthy as to hesitate now that a "glorious example" had been set for it? [87]

But was New York's example the canal or the taking of great risks? To canal advocates it was the former, and any other interpretation of the New York example was considered ridiculous. One canaller, for example, explained the existence of railroad agitation in Pennsylvania as follows:

> . . . we would fain be, *at once,* in the *true fold* with New-York; but we would not pursue the like measures to arrive there; we would like to *climb up,* and enter by a *nearer* passage, created by our imaginations; we would establish our best interests, as it were, by *Magic.*[88]

But railroad advocates might have answered—they did not so far as I know—that it was the use of imagination and the magic of a new technique that put New York in the "true fold." Furthermore, if any long-range project through undeveloped areas yields huge benefits, New York might well have chosen a cheaper part-canal, part-river improvement project extending to Lake Ontario rather than all the way to Lake Erie and thereby have avoided the risk involved in building the country's first long-range canal.[89] It is evident that the canal party was willing to imitate, not New York, but New York's project, for it was the success of that project that seemed to provide certainty.

THE CANAL AND RAILROAD RECORD

How could the railroad party combat these arguments from experience? Certainly not by means of non-empirical counter-arguments. In view of the differences between the geography of New York and Pennsylvania, so the railroad argument ran, a Pennsylvania canal *would* fail of its objectives although the Erie Canal *had* succeeded. This was bound to be ineffective. In view of the technical attributes of the railroad, so the second railroad argument ran, it *would* succeed. But had it succeeded in the past, as the Erie Canal had demonstrably succeeded? This was apparently the crux of the issue for the bulk of the improvement movement. The only type of argument that could weaken the influence of the Erie Canal experience was a demonstration, on the one hand, that canals had actually failed and, on the other hand, that railroads had actually succeeded. Experience was the key. The analysis of the general railroad and canal experience up to 1825 was therefore a crucial aspect of the debate.

[83] *Facts and arguments,* 17–19.
[84] "Alnus," *U. S. Gazette,* December 30, 1825.
[85] "Brindley," *U. S. Gazette,* December 17, 1825.
[86] *Internal improvement—No. 4. Railways and canals,* 2.
[87] "Canals and Railways—No. 4," signed "Fulton," *U. S. Gazette,* February 16, 1825.
[88] "Northumberland," *U. S. Gazette,* September 22, 1825.
[89] For a New Yorker's defense of the cheaper project, see [Beach, Samuel B., ?], *Considerations against continuing the great canal west of the Seneca . . . by Peter Ploughshare,* n.p., *passim,* n.d.

In this empiric field, the railroad party had to depend upon the British experience. For only in Britain could they find a statistical record of canal operation that was not dominated by a success of the magnitude of that of the Erie; and only in Britain could they find any record at all of railroad operation. The canal advocates, on the other hand, while equally adept at utilizing the British statistics, had good reasons to keep returning to the American record. The result was a battle of statistical averages that might well have tried the patience of any audience in the world except the newspaper readers of Philadelphia.

The most adept of the statisticians was also the man with the sharpest pen in Pennsylvania. Mathew Carey was presented with an excellent opportunity to combine statistics with satire when "Examiner" (the author of *Facts and Arguments,* according to Carey), indulging in his proclivity for overstatement, wrote that canals were "an antiquated and nearly exploded system." Carey remarked simply that this would be quite novel information to the American public and proceeded to the record already produced by the current American canal mania. Canals, Carey pointed out, were in progress in almost every state in the Union—"not one of which, but the unfortunate state of Pennsylvania is distracted by the question between canals and railways." Ohio was already digging its two canals; the United States engineers were surveying for the Chesapeake and Ohio; "those splendid monuments," the Erie and the Champlain, were in "triumphant" operation; Pennsylvania was completing the Union Canal. "If these be signs of an 'exploded system,'" remarked Carey," . . . the arts of printing and steam-navigation are 'exploded.'" As for the English record, Carey asserted that the shares of every canal in Great Britain "which is properly located, and in a part of the country where there is considerable traffic" were selling at levels ranging from twenty to one thousand per cent above their original prices.[90]

Carey's description of American canal activity was difficult to answer, for the movement was not old enough to have revealed the long-term consequences of the less-justified projects. The English record, however, was much older and consequently, on the average, much sadder. A pro-railroad writer therefore seized on Carey's British statistics. On the basis of the London Trade List, he was able to demonstrate that canal stocks in England were earning an average of not quite one-quarter of one per cent per year and were selling for less than one-third their original cost. "Canals," he concluded, "are not always Eldorados"—a new thought for many Americans in 1825.[91]

An analysis of the averages drove home the lesson. Canals, "Examiner" wrote, had certainly benefited Great Britain, but they could be compared to lotteries: "a *few* great prizes; but *many* smaller, and some blanks are drawn." About one-seventh of the British canals, he claimed, had yielded large dividends; the remainder yielded little or nothing.[92]

Clearly, the railroad party won the battle of the British canal statistics. But there was more to the war. Firstly, it is difficult to moderate a mania in one country by pointing to consequence in another three thousand miles away. Secondly, there was the other, more important side to the question: railroaders had to prove not only that canals had failed, but that railroads had succeeded. Both sides turned, therefore, to the British railroad experience.

The record seemed impressive. As noted above, the Philadelphia press periodically filled with reports of the wondrous railroad projects afoot in England and Scotland.[93] *Facts and Arguments* spent pages on the British plans: the remarkable number of companies recently organized there, four of which proposed to build no less than two thousand miles of tracks; the plans for a four-hundred-mile London-to-Edinburgh line, together with several branches; the proposed London-to-Birmingham-to-Liverpool-to-Bristol line; finally, the Liverpool and Manchester.[94] Another railroad advocate reported that nearly thirty public railway companies were formed in Great Britain during 1825, with stock subscribed "upwards of £15 million"; this in a country with more than three thousand miles of canals. Such was the belief in railroads there that, according to "Alnus," the President of the Board of Trade predicted in the House of Commons that within twenty-five years "'every canal in England would be a dry ditch.'" More important, shares of the Liverpool and Manchester Railroad were selling at 1,600 per cent advance; shares of the Stockton and Darlington at 20 per cent advance.[95]

Furthermore, all these projects were backed by the weight of respected British authorities. When Carey wrote that information on railways in America was crude and derived from theorists, he could be confronted with "all the engineers, etc. of Europe," for Strickland had reported that there was but one opinion on the subject in England. And then there were all the well-known engineers who had written on railways—"Does our friend stigmatize Jessup, Wood, Sylvester, Stevenson, etc. as theorists?" [96] There was

[90] *Internal improvement—No. 3. Railways and canals,* 1.

[91] "Alnus," *U. S. Gazette,* December 15, 1825.

[92] *U. S. Gazette,* December 12, 1825.

[93] See also the reprint from the *London Mag. and Rev.* for January, 1825, in the *National Gazette* of March 9, 1825; and the reprint from the London *Public Ledger* in *U. S. Gazette,* March 11, 1825, which described the remarkable power of a locomotive during an experiment at a colliery.

[94] Pp. 21–23.

[95] *U. S. Gazette,* November 8, 1825.

[96] "Examiner," *U. S. Gazette,* November 23, 1825. However, "Examiner," in this article, had to disassociate the railroad movement from one of the well-known railroad writers, Thomas Gray, whose "wild, incoherent and inconsistent statements . . . are charged on the friends of railways. . . ."

indeed justification for another railroad advocate's remark that, while many engineers advocated railroads in preference to canals, not one of the numerous opponents of railways appearing in print was an engineer.[97]

The only recent event in England of any use to the canal party was the battle between canal and railroad interests before the Parliamentary Committee considering the Liverpool and Manchester Railroad bill. English canal representatives, fighting a rear-guard battle, hopefully exhibited their answer to the railroad's great speed advantage: a steamboat which, instead of a paddle, used a fin that presumably would not agitate the water and destroy the canal banks even at high speed.[98]

The Liverpool and Manchester Railroad bill was defeated in the parliamentary committee by a majority of one. This was not conclusive evidence against railroads, Carey admitted, but he nevertheless considered it important evidence, for there was no part of Britain where a railroad could have been more useful—the canals were insufficient for the traffic, the delays were long, and the distance short. That the bill failed proved to him, at the very least, that the advantages of railroads were not regarded by Parliament as "quite as certain and striking as we have been taught to believe." [99] But it was common knowledge, railroaders answered, that it was the pressure of canal interests that had caused the bill to fail; it was fully expected to pass at the next session of Parliament.[100]

However, canallers were not completely without resource in this field. Though unable to deny the existence of railroad enthusiasm in England, they could attribute it to peculiar conditions non-existent in the United States. One great inducement to projecting railroads there, it was pointed out, was the high tolls which canal companies maintained despite huge profits. Then there were the differences in geographical conditions: no real mountains, a country completely cultivated, no immense forests. There were also the differences in factor and commodity supply: labor and iron were cheap, and an "immense capital unemployed" which sought every avenue affording the slightest prospect of a small return. Finally, while English railroads would carry primarily commodities of small bulk in proportion to their value, that is, manufactures, American commodities "are just the reverse." [101] So strongly did one canaller feel about the dangers of following the British model that prose proved inadequate and poetry appeared:

RAILROADS, TUNNELS AND CANALS

Address to the Eutopian Society by Solomon Simple, Esq.

. . . . . .

What's wise for Britain in her present state,
Might lead her votaries to Bedlam's gate;

. . . . . .

There some Eutopian scheme must fill the void
Which wealth o'ergrown creates, when not employed—
There surplus capital is always found
To sow prolific seed o'er Fancy's ground:
Like her Columbia may the Earth explore
For hidden treasures of metallic ore,

. . . . . .

But ne'er should waste her strength in any schemes;
Prefer machinery to mere manual skill,
Replace the distaff with great Arkwright's mill;
For art centuples what one hand can yield,
Like golden harvests ripening on the field,
But yet, beware! nor too presumptious soon
To fancied regions of mechanic power,
Nor strive too soon thy mountains to subdue,
By making rail-roads o'er or tunnels through
But by canals pursue some kindly stream

. . . . . [102]

But even poetry could not completely stem the tide. British plans and projects were bound to create a climate of expectations in the United States favorable to railways. Indeed, British expectations of an American railroad boom were reported in the Philadelphia press. According to one Englishman, it was not surprising that in a country "where every faculty of human nature and every discovery in art and science is developed with such marvelous energy," that "railroads have excited the strongest feelings of interest. . . ." [103] According to another, with such a nation, interest meant action: "There can be no doubt of their immediate adoption throughout the whole country." [104]

Inevitably the prevalent attitude in Britain did spread to Pennsylvania and the implications for the state were drawn: ". . . we must not calculate on a further extension of the Canal system in Pennsylvania," wrote an opponent of the proposed Schuylkill-Delaware canal. "Railways will undoubtedly supercede it, and at no very distant period. This is now taking place in Great Britain, and it must inevitably occur in this country." The writer then referred to the striking change in Pennsylvania opinion:

> Six months ago to advocate railways was considered visionary by many—even of our intelligent citizens, but at present the aspect of affairs is totally changed. Many men of talent and science have embraced the cause of railways. The press teems with essays in their favour. . . ." [105]

There was actually a small wave of euphoric railroad planning here in 1825. In September, a Phila-

[97] "Alnus," *U. S. Gazette,* November 11, 1825.

[98] "Canals vs. rail roads," *U. S. Gazette,* June 23, 1825.

[99] *Internal improvement—No. 2. Railways and canals,* 2.

[100] "Alnus," *U. S. Gazette,* November 11, 1825; "Examiner," *U. S. Gazette,* November 23, 1825. The bill was re-introduced and passed at the next session. See Jackman, *op. cit.* **2**: 522–524.

[101] "A.Z.," *Poulson's,* May 3, 1825. See also, "H," *U. S. Gazette,* September 5, 1825.

[102] *National Gazette,* March 19, 1825.

[103] Quoted in the *National Gazette,* March 9, 1825.

[104] Article in the London *Courier* reprinted in the Baltimore *American* and copied from there by the *U. S. Gazette* of March 9, 1825. See also the article reprinted from *The Scotsman* in the *National Gazette* of February 26, 1825.

[105] *U. S. Gazette,* August 17, 1825.

delphia town meeting called for a railroad between the Schuylkill and the Delaware "on the system of inclined planes." [106] On December 5 a meeting of citizens of Susquehanna County was informed of a New York citizens' proposal for a line of transportation from the Erie Canal to the Belmont Coal Mines, at the head of the Lackawanna coal region. The line was to consist of a railroad from the Erie Canal to Lake Otsego, and improvement of the Susquehanna River for navigation by steamboats from that lake to the Pennsylvania line. The citizens of Susquehanna County heartily endorsed the proposal, called for extension of the line by means of a railroad down the Lackawanna Creek to Wilkes-Barre, and asked the legislature to incorporate a company to construct it.[107] On December 19 two projects for railroads between the North Branch of the Susquehanna and the Delaware River had bills reported in their favor in the state legislature.[108] Furthermore, the *United States Gazette* reported on January 3, 1826 that a meeting of citizens of Columbia County resolved for a railroad from Pittsville to the Susquehanna.

The movement was not confined to Pennsylvania. When Carey remarked that Pennsylvania had the misfortune to be the only state distracted by the railroad question, he could be answered with a remarkable number of examples:

> . . . in Virginia it is proposed to connect the eastern and western waters by railway from James river to the Kenhawa. In Ohio, a memorial to the Legislature, praying for the construction of a railway of great extent is now in circulation. In New-York, a company is formed to construct a railway from Schenectady to Albany, *for the express purpose of superseding that portion of the Grand Canal;* surveys are also in progress for similar purposes in New-Jersey and Georgia.[109]

Thus, the railroad record in England and even in America seems extremely impressive, and the Pennsylvania decision all the more remarkable. But let us return to our theme: the canal advocates claimed that the canal was proven by experience, the railroad was not. It is from this point of view that the rejection of the entire railroad record becomes understandable. The issue was first put clearly at the Harrisburg Convention in August, when "Mr. Tweed of Northumberland" confronted the railroad party with the flat assertion that there was no relevant railroad record; that in all his recent extensive travels in England he had seen many canals, but not a single railroad—though he had heard of one small line. Furthermore, he had found widespread doubt in England of its practicability.[110]

Tweed was of course violently attacked for this statement; that a half-century of railroad experience had produced about two hundred railroads in Great Britain could hardly be seriously denied. As one railroader put it, "a well informed man could not walk a mile in many of the manufacturing districts of . . . [England] without seeing in full operation both a public canal and a private rail-road." [111]

But the distinction between "private" and "public" was precisely the point, replied Tweed. He had not been referring to railroads "of a local nature, situated in or about the mines . . ." and therefore hidden from the view of the ordinary traveler. The utility of such railroads, he agreed, was proven by their widespread use, especially underground, not only in Great Britain, but even in the United States. The doubts in England to which Tweed referred "were attached to the project of *extending* rail-ways from *local purposes,* to which they had been hitherto confined, so as to answer *public purposes.*" On the basis of this distinction, Tweed was easily able to demolish the contention in *Facts and Arguments* that the English experience had proven the railroad, for the author of *Facts and Arguments* was proposing a "public" railroad, whereas the railroad experience thus far was with "private railways." [112]

This was the justifiable basis for the canallers' attack on the relevance of the British experience. Even an authoritative proponent of railroads, Thomas Tredgold, could be quoted by Carey to good effect on this distinction:

> Up to this period [1825], railways have been employed with success only in the conveyance of heavy mineral products, and for short distances, where immense quantities were to be carried. In the few instances where they have been intended for the general purposes of trade, they have never answered the expectations of their projectors.[113]

This quotation from the great authority would have lost some of its effectiveness if Carey had added the very next sentence: "But this seems to have arisen altogether from following too closely the models adopted for the conveyance of minerals; such modes for forming and using rail-ways, not being at all adapted for the general purpose of trade." Nevertheless, Carey's central point was valid: there was no successful experience with a general-purpose railroad. Carey, like Tweed, was more than ready to admit that experience had proven the "immense advantages" of railroads from mines to places of water shipment. But could anyone be so infatuated, he asked, "as to embark millions of dollars in an experiment which 'for general purposes,' 'has never yet answered the expectations of the projectors!' when they have a mode of communi-

[106] *Poulson's,* September 27, 1825. See also the debate on this proposal in the issues of October 6, 7, and 15, 1825.
[107] See *U. S. Gazette,* December 13, 1825.
[108] *Poulson's,* December 21, 1825.
[109] "Examiner," *U. S. Gazette,* December 12, 1825.
[110] Reported in *U. S. Gazette,* August 12, 1825.
[111] "Alnus," *U. S. Gazette,* August 15, 1825; see also, "Alnus," *U. S. Gazette,* November 11, 1825.
[112] *U. S. Gazette,* August 30, 1825.
[113] Quoted in Carey, *Internal improvement—No. 2. Railways and canals,* 4n; and in *No. 4,* 3. The quotation is from Tredgold, *op. cit.,* 8.

cation at their command which, honestly and judiciously managed, has never failed of success?" [114]

The emphasis upon the distinction between "private" and "public" railroads made it particularly important to evaluate the obvious failure of the only general-purpose railroad in Great Britain, the Surrey Railroad.[115] Tredgold, quoted by Carey, ascribed the failure of the Surrey to the use of flat-bar rather than edge rails; to the necessity to transship goods because the railroad cars could not travel upon turnpikes; and to the great weight and small carrying capacity of the cars. Carey added that, in his opinion, the flat-bar rails were not very important as a cause of failure; he thought the principal cause was "the necessity of unloading and reloading." Here, Carey stressed, was a prominent case of a general-purpose railroad with twenty years of experience, and it was a failure.[116]

In reply, the railroad's defenders emphasized precisely the Surrey's age—it was constructed in 1804, which accounted for its outmoded rails and its uneconomic cars. Furthermore, a canal which ran parallel to the railroad drew some of the trade but was no better off financially. Above all, the railroad's defenders were concerned to rescue Tredgold—a popular railroad authority and enthusiast—from the surgical effects of Carey's truncated quotations. Tredgold had actually stated that the Surrey Railroad would have been a success if it had used edge rails and lighter, larger cars with larger-diameter wheels. His description of the problem of loading and unloading, on the other hand, was intended to illustrate the fact that both canals and railroads were not suitable for very short-range hauls. As the railroad advocates put it, they had not realized before reading Carey that canal boats were amphibious and could travel on turnpikes.[117]

Obviously there was a strong case for considering the twenty-year-old Surrey Railroad record irrelevant to the issue. But there was not much help in that; with the Surrey ruled out and the Stockton and Darlington too new and not really a general-purpose road, the railroad party could not point to a single successful example. The entire fifty-year record of railroad experience in Great Britain, invaluable though it was for determining specific technical characteristics of the railroad, could not provide the security that would have been granted by a completely relevant experience. Railroad advocacy in Pennsylvania therefore appeared exotic. Its supporters were the "theorists" of the debate, in opposition to the "practical" people who relied on experience and supported the canal. This was a crushing political liability; the taxpayers of Pennsylvania were not theorists but practical people.

EXPERIENCE VERSUS EXPERIMENT

We have reached a fundamental difference between the two positions. Whereas canal advocacy was based upon experience—largely a single experience, but a near and dramatic one—railroad advocacy had to depend upon an uncertain projection of current technical trends. That this was involved in the choice confronting the leaders of the mainline movement was first made clear by Strickland's report on railroads, then by his correspondence with the Society. The mainliners had fully expected Strickland's report to settle the railway issue one way or the other. But when his first report supported the railroad with what they regarded as insufficient proof and they wrote to him demanding "facts and arguments of an entirely conclusive nature," all he could answer was that he could provide no certainty because no long-range general-purpose railroad had as yet been built.

The correspondence with Strickland, therefore, marked a turning point in attitudes toward the railroad in Pennsylvania. Ever since the time that the railroad had first come to prominence in the early 1820's, when John Stevens obtained his railway charter and reports of English experience were featured in the Philadelphia press, the leaders of the improvement movement had reacted positively to this new tool in the technical armory of improvement enthusiasts. Mathew Carey had agreed to serve as a director of Stevens' railroad company, and the Pennsylvania Society had sent Strickland to Europe and had published favorable technical reports. Their view was entirely rational. The people would soon be properly informed on the advantages and disadvantages of the railroad relative to the canal and on that basis would make their decision. These expectations, reasonable when applied to the routine decisions of business and political life, were doomed to disappointment when applied to the railroad. They had overlooked the inevitable unavailability of crucial facts in the planning of an innovation—whether it was a long-range canal in 1817 or a long-range railroad in 1825. In September the Strickland correspondence confronted them with this unpleasant fact. Thereafter the railroad was not a

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[114] *Internal improvement—No. 4. Railways and canals,* 3. See also *No. 5,* 4; and "Hamilton" [Carey], *U. S. Gazette,* January 10, 1826.

[115] Tredgold, *op. cit.,* 16, refers to the Surrey Railroad as "one of the few attempts to form public rail-roads for general use. . . ." Jackman, *op. cit.* 2: 472, refers to it as the only important tramroad apart from those leading to coal and other mineral supplies. If there were any other general-purpose lines in 1825, they are not prominently mentioned in the literature and were certainly unknown to Pennsylvanians. Jackman, *op. cit.* 2: 483, refers to the Stockton and Darlington, which opened in 1826, as an intermediate between the colliery roads and the modern railroads because, while it was for public use, it carried mainly coal and its passenger traffic did not develop much before 1832.

[116] Carey, *Internal improvement—No. 1. Railways and canals,* 2–3. Tredgold took up the Surrey Railroad on 12–17.

[117] "Audi Alteram Partem," *U. S. Gazette,* October 15, 1825; "Alnus," *U. S. Gazette,* November 8, 1825; "Examiner," *U. S. Gazette,* November 23, 1825. Their references to Tredgold's opinion were accurate. See Tredgold, *op. cit.,* 16–17.

great new opportunity; it was instead an insidious danger. For it meant that people's vague feelings—basically their attitudes towards new things in general—could determine their opinions to an unusual degree. Some expected great things of the new mode; others did not. Some were willing—in fact eager—to take a step in the dark; others preferred the light of experience. Some saw in Britain's industrial development America's future; others warned against that dangerous road—and therefore opposed the railroad. Since both the potentialities and the weaknesses of the new technique had yet to be tested adequately, vision, judgment, and just plain prejudice had to determine opinion. The mainline leadership preferred "facts." As an opponent of railways put it, the most impressive thing about the Report of the Committee of the Harrisburg Convention was that it did not indulge in "speculative theories," that it relied only upon "strong, conclusive *facts*," facts that could not be weakened "by any system of reasoning. . . ." [118] As another canaller put it, the railroad was "a bauble, a play thing," its practical use doubtful, while the canal's utility was "tangible, and strikes conviction upon the understanding of every man who beholds it. . . ." [119]

The uncertainty connected with the railroad was particularly important in Pennsylvania, where private capital refused to enter the field on the side of either canal or railroad. The issue was ultimately in the hands of the voting population and the mainline movement had to take this into account. As a canal advocate put it, the state had to confine itself to "something solid, the usefulness of which is not doubted, but tested by experience; such undertakings will always have *public confidence* to promote them." [120] In contrast, the merchants of Baltimore faced no such problem. As the next Part will demonstrate, their very willingness to initiate their railroad project produced the popular confidence needed to carry it through.

For the railroad advocates in Pennsylvania, however, the need for state initiation of the project was a tremendous disadvantage. Carey found it effective merely to list the predictions of the author of *Facts and Arguments:* that locomotive railroads would eventually make it possible to visit the village of Astoria on the Pacific coast in ten days; that merchandise would soon be transported from Philadelphia to Pittsburgh in four days and four hours; that the transportation of goods from Philadelphia to Pittsburgh would not be more expensive than it now was to Germantown. These, together with the inevitable over-optimistic exaggerations, must have convinced the people of Pennsylvania of the truth of Carey's characterization of the author: "a young man, destitute of experience, a great zealot and visionary . . . known for nothing so much as a visionary temperament. . . ." [121]

In a sense, Carey was right. There was indeed a visionary element in the railroad enthusiasm of the period, but it stemmed, not merely from a vague optimism, nor from a single striking example, but from an understanding of the truly staggering potentialities of the new technique. Its advocates knew that a long step in the progress of mankind was involved; they perceived that the railroad was the historic solution to the long-range transportation problems of continental areas. This inspiring insight was probably the railroad party's most effective counter to the wave of canal enthusiasm generated by the Erie Canal. For they knew, as we know now, that the potentialities of the railroad were such as to put even the Erie Canal into the shade.

The railroad vision was based upon two factors that were mentioned above in connection with the technical aspects of the debate between railroad and canal. Firstly, the railroad could be built anywhere—it was independent of a water supply. Secondly, the railroad's speed could be increased without increase of friction on the track. From these two factors everything followed.

It was the speed factor especially that fired the imaginations of the railroad enthusiasts. A British writer pointed out that it had been believed for some time that, whereas water resistance on a canal increased as the square of the boat's velocity, friction on railroads increased only in proportion to the car's velocity. But recent experiments of Coulomb and Vince had shown that the friction remained the same for all velocities. The implications of this discovery were, for this writer, staggering:

> ignoring air resistance (which increases as the square of the velocity) if a car were set in motion on a level railway with a constant force greater than necessary to overcome its friction it would continually accelerate! . . . Further, the very same amount of constant force which impels a railway at two miles per hour would impel it at ten or twenty miles per hour if an extra force were used to overcome the inertia of the car and generate the required velocity. . . .

So remarkable was this fact that the writer could hardly contain his imagination; in developing all possibilities, he almost foresaw the artificial earth satellite:

> . . . assuming that the resistance of the air were withdrawn, if we suppose a horizontal railway made around the globe, and the machine (supplied with a power exactly equivalent to the friction) to be placed on the railway, and launched with an impulse with any determinate velocity, it would revolve forever with the velocity so imparted, and be in truth a sort of secondary planet to our globe.

This of course was a flight of fancy, and one that certainly must have justified the fears that railroad advo-

[118] "Amicus." *U. S. Gazette,* November 28, 1825.
[119] "Calculator," *Poulson's,* September 30, 1825.
[120] "Tweed," *U. S. Gazette,* August 30, 1825.
[121] *Internal improvement—No. 5. Railways and canals,* 4.

cates were "theorists." But the immediate consequences were inspiring enough: because of the nature of the resistance on railways, a high velocity could be attained almost as cheaply as a low one. Indeed, there was "scarcely any limit" to the velocity; it could reach such heights that air resistance, ignored up to that time, "would become the principle retardative force." [122]

What would be the social consequences of this "new power of locomotion?" this perceptive British writer then asked. Here again he was little less than prophetic. The outlying towns of an extensive empire, he predicted, would be transformed into "so many suburbs of the metropolis." With commodities, inventions, opinions, and feelings circulating with enormous rapidity, with "the personal intercourse of man" vastly increased, he even anticipated the unification of Europe as the result of the building of a railroad system.[123] As for America, ". . . the 150 millions who will inhabit North America next century will be more completely *one people* than the inhabitants of France or Britain at this day." [124]

Thus, the railroad appeared to its advocates as much more than just another transport improvement. It would open prospects of "boundless improvement" and it would produce a greater effect upon society than even "the grand discovery of navigation." [125] There was virtually no limit to its potentialities as seen in 1825. In this sense there was actually a visionary aspect to the railroad agitation. When the canal party hurled those invectives—"restless spirits," "visionaries trying to be wiser than their Fathers," "Theorists"—the railroad advocates could first try to deny the charges by reference to a rather meager experience; then they could appeal to history and point out that any shopkeeper in modern times traveled at speeds inconceivable to the ancient Romans.[126] But against the general charge—that they tended to destroy people's peace of mind, that they were undermining those arguments based upon experience that provided people with a feeling of certainty—against these charges there could be no effective defense because they were true.

Towards the end of the debate, a canal advocate, doubtless disturbed by its intensity, pleaded for a lost peace and certainty: "let us pursue the even tenor of our way." "Pshaw!" answered a railroader. "Socrates was poisoned—Roger Bacon was twelve years imprisoned—John Huss was burned—and Galileo was emasculated, and had to abjure his discoveries, because their persecutors wanted to follow 'the even tenor of their way.'" [127] An inspiring answer, but not one calculated to win over the taxpayers of Pennsylvania. The railroad party simply could not escape the popular tag of "visionary." For, in the best sense of the word, they deserved it.

In the end, therefore, the railroad enthusiasts openly accepted the mantle of "theorists" and thereby implicitly admitted the weakness of their attempt to establish an adequate record of experience for the type of railroad they advocated for Pennsylvania. This was inevitable; even the British railroad advocates, close as they were to the only experience available to the world, were forced to place themselves in opposition to the "practical man, who is generally an incorrigible dogmatic as to the nostrums, right or wrong, which his own narrow experience has taught him, and stubbornly incredulous as to everything beyond them." [128]

"Experience vs. Experiment" was the heading, not of a pro-canal but of a pro-railroad article written by a Pennsylvanian towards the end of the debate. The author did not deny that there was insufficient experience with the railroad. Instead he pointed out that to require experience was to prevent the introduction of any and every important improvement—turnpikes, canals, steamboats were all once untried. What then should be the criterion for adoption of an improvement, he asked. Examine its nature and principles, he replied, investigate its properties, inquire whether it is adaptable to the situation and ascertain the results of "local and partial experience." This course, considered proper by "a prudent individual when he prepares to engage in an undertaking to promote his prosperity," was also proper for "the public" when an untried scheme promised important benefits. From a candid investigation, "correct and safe inferences can always be drawn; and the conclusion can stand in the place of experience until experience verifies the expectations. . . ." [129] This was the basic argument for considering the railroad. Opposed to it was the "astonishment" of the canal advocate at the fact that anyone could call upon the people of Pennsylvania to give their support *"to a measure as yet untried. . . ."* [130]

THE POSTPONEMENT PROPOSAL

The astonishment of the canal advocate is understandable if we assume, as did the great majority of the improvement leaders of the state, that the only choice was between immediate construction of a canal and immediate construction of a railroad. Indeed, considering the state of railroad knowledge at the time,

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[122] Article reprinted from *The Scotsman* in *American Mechanics' Mag.* 1: 164–166, April 16, 1825. See also, 182–183, April 23, 1825.

[123] *Ibid.* 1: 183–184.

[124] Article reprinted from *The Scotsman*, in *National Gazette*, February 26, 1825. This is another part of the article that was reprinted in part in the *Amer. Mechanics' Mag.*

[125] *Amer. Mechanics' Mag.* 1: 147, April 9, 1825.

[126] See *ibid.* 1: 183–184, April 23, 1825.

[127] "Alnus," *U. S. Gazette*, December 15, 1825.

[128] Article reprinted from *The Scotsman* in *Amer. Mechanics Mag.* 1: 180, April 23, 1825.

[129] From *The Recorder* of York, Pennsylvania, reprinted in *U. S. Gazette*, November 1, 1825.

[130] "H," *U. S. Gazette*, September 5, 1825.

the Baltimore decision to proceed immediately with a railroad to the Ohio seems even more remarkable than the Pennsylvania decision for a canal over the mountains. However, the Pennsylvania railroad advocates recommended, not immediate construction of a railroad, but a postponement of the entire decision until more information was available. This puts the issue in an entirely different light. Though that "local and partial experience" was an insufficient basis for immediate construction of so huge a project, it should have been sufficient to cause serious consideration of a few years' delay.

In proposing postponement, the railroad advocates stressed above all the incipient projects in England: "As they are about to be constructed there with lavish expense and the utmost skill, the United States will enjoy the benefit of a complete experiment for guidance." [131] Consequently, it was a "correct and safe" though not certain inference that technological innovation in the railroad field, so rapid in the recent past, would continue.[132] From this the railroad advocates drew certain implications of great importance to the future of Pennsylvania. Firstly, they foresaw that the railroad would have a decisive effect upon the rivalry with New York City: "Those towns on the seaboard of the United States that cannot have an extensive intercourse with the interior by Canals, will be compelled to adopt Rail Roads. . . ." [133] Secondly, they forecast the consequences for Pennsylvania if a canal mainline were built. Sometime in the near future, one of them predicted, "public" general-purpose railways would be proven by experience to be as superior to canals as were "private" specialized mine railways. At that time, "some of our enterprising capitalists" would find it profitable to build a full railroad from Philadelphia to Pittsburgh in competition with the canal mainline. Such a railroad, he asserted, would destroy the value of the canal. It would carry freight more cheaply, with greater speed and safety, by a shorter route, and throughout the year. "Should the advocates of canals gain a victory," he warned, ". . . *it is one they will never boast of.* An error committed at present will have the most serious consequences on the future destinies of this state." [134]

As it turned out, a delay of the railway-canal issue for only a few years would have been sufficient to settle the issue clearly. As noted, the Stockton and Darlington, which opened in September, 1825, with a spectacular locomotive run, was an immediate and impressive success. The Liverpool and Manchester obtained its charter early in 1826. When the line was nearing completion in 1829 the company held an internationally famous prize contest for construction of the best locomotive suited to their line. The "Rainhill Trials," held in October, 1829, proved to the world, conclusively and dramatically, the practicability and immense advantages of the locomotive. The Liverpool and Manchester was the first true general-purpose railroad, carrying passengers and various kinds of freight, and using no other power but the locomotive. Completed in September, 1830, its operations created an immediate public impression. Its passenger trains ran at twice the speed of the fastest stage coach, it reduced the cost of traveling by about half, increased the value of passenger traffic four-fold, and reduced freight rates by about one-third. In addition to all this, the road was a financial success. "With the Liverpool and Manchester line, the railway era really began." [135]

All this occurred four and one-half years after the Pennsylvania decision for canal construction. It was foreseen by the Pennsylvania railroad party because these English projects were either planned or under construction during 1825. Perhaps so great a success could have been foreseen only by "visionaries." But that there was good reason to wait and see should have been obvious to all.

IV. CAUSES OF THE DECISION

WHY DID THEY NOT POSTPONE?

One explanation for the refusal to consider a delay appears immediately from an examination of the improvement literature: there was apparently a panic reaction to the success of the Erie Canal. "The delay of a year may prove fatal . . . ," wrote the *Pittsburgh Gazette;*[1] "We now contend for existence, or all that makes existence desirable . . . ," warned the *United States Gazette* in regard to Pennsylvania's delays.[2] This nervous attitude was displayed even toward the Strickland mission to Europe. The Society expected his report within a few months; Carey, in March, expected "full and ample information" in three to five months.[3] But even this short delay provoked a sharp editorial protest from the *United States Gazette:* "We

[131] *National Gazette,* March 9, 1825; see also the issue of March 24, 1825.

[132] See *Internal improvement—Railroads, canals, bridges, etc.,* 13.

[133] From the Boston *Palladium,* reprinted in *U. S. Gazette,* March 23, 1825.

[134] "Alnus," *U. S. Gazette,* December 30, 1825.

[135] Jackman, *op. cit.* **2**: 524–527. The Stockton and Darlington is considered a transition type of road: "The metamorphosis which the railway underwent from the Stockton and Darlington, as it was then, to the Liverpool and Manchester, is somewhat analogous to that between a grub and a butterfly. The former was the highest development of the old colliery railways; its locomotion being effected partly by horses and partly by primitive engines of the Killingworth type; the latter, a fresh departure altogether and the prototype of the evolution during the following century." Marshall, C. F. Dendy, *A history of British railways down to the year 1830,* 199, London, Oxford Univ. Press, 1938.

[1] Quoted in *Niles' Weekly Register* **29**: 164, November 11, 1825.

[2] Editorial, March 12, 1825.

[3] "Canals and railways—No. 6," *U. S. Gazette,* March 28, 1825. Signed "Fulton."

fear that the love of procrastination, that 'sin which most easily besets us,' will paralyze . . . improvements. . . ." [4]

The changing attitudes of the *United States Gazette* toward the railroad illustrate the importance of this fear of delay. This leading Philadelphia daily had at first reacted with hostility to the railroad idea, but the publication of *Facts and Arguments* during the summer made a great impression on the editor. Subsequently the paper urged serious consideration of a full railroad line.[5] By October, 1825, however, the paper was stressing, not the relative advantages of railroads and canals, but the terrible dangers of delaying the mainline:

> It is necessary to our prosperity, nay, almost to our existence, and every day that the work is delayed, is strengthening and multiplying the advantages that our gigantic neighbor has acquired over us.[6]

Consequently, the paper was entirely in favor of the mainline canal construction bill of February, 1826. The bill was passed in a great hurry—before adequate surveys could determine the route and before the method of crossing the mountains was decided—and the *Gazette* did admit that, in passing the bill, the House of Representatives might "appear to some rather hasty." But haste was an absolute necessity: "By further delay, the public *excitability* would have been wasted, and so powerful an opposition raised to the measure that its final adoption would have been doubtful." [7]

Carey's remarks on the fate of the Liverpool and Manchester Railroad bill in the committee of the House of Commons provide the clearest illustration of this attitude. The bill failed by a majority of one, and Carey utilized this fact in arguing that English opinion was not unanimously on the side of railroads.[8] He added, however, that he had earnestly hoped that the bill would pass and

> thus, a fair experiment been early made with foreign capital, so as to enable the state of Pennsylvania to profit by that experiment, before she decided the important question between canals and railways. The failure of the bill, therefore is sincerely to be regretted.[9]

But the bill was to be reintroduced at the next session of Parliament. Even a short delay was evidently out of the question.

The symptoms of panic were particularly pronounced whenever the Erie was mentioned.

> Whenever we hear of the New York canal a kind of tremor seizes our frames. Whenever we hear Mr. Clinton's speeches or reports, we can hear old Cato's 'delenda est Carthage' thundering in our ears. . . .[10]

It is a striking fact that the Erie was not considered as simply an aid to a competitor's trade; the fear was not that New York, already larger than Philadelphia, would be still larger in the future. Instead, the improvement advocates wrote as if the Erie Canal confronted Philadelphia with utter stagnation. To the Committee of the Harrisburg Convention, the issue was, "whether we shall allow our state to be drained of its wealth, to increase that of a neighbor already advanced to a towering height." [11] As a bitterly anti-railroad mainliner put it:

> We observe our population daily diverging from our state. . . . We have beheld our markets neglected . . . we observe our stage coaches pass empty; and our roads with hardly a solitary traveller; while we hear that 40 stages leave Albany daily, with 700 passengers. We have found that while we slept our *locks* have been shorn. . . .[12]

A part of the explanation for the remarkably intense reaction is that the Erie Canal was considered the symbol of all the projects that were soon to surround Philadelphia. As one Philadelphian put it, "A most important reason for acting definitively at this session is that Ohio will certainly commence her Canal next summer." If it were finished before the Pennsylvania canal, New York would have an "irretrievable advantage" in the Lake trade. On the other side, he warned, Maryland and Virginia were about to commence a Potomac canal to the west, for the United States Engineers had reported in favor of it. If these three canals—the Erie, the Potomac, and the Ohio—were all completed before Pennsylvania's, they would draw the commerce, the wealth, and the population of Pennsylvania, "and leave us to weep over our inertion [sic] and infatuation. . . ." [13]

It cannot be denied that there would be plenty to weep over. Up to 1825, that is, up to the appearance of the railroad as a serious alternative, to admit that a Pennsylvania canal could possibly fail, or not be built at all, or built too late, was to admit that Philadelphia could not compete in the western trade; it was an admission that, in a period when foreign commerce by itself could no longer provide great opportunities for expansion, the city and those parts of the state associated with the city's development were barred from participation in the greatest opportunity of the age, the expansion of the west. But all these factors were operating in Baltimore and Massachusetts as well, and we are interested at this point in the special characteristics of the Pennsylvania case. Was Pennsylvania

[4] March 22, 1825.
[5] See above, p. 27.
[6] Editorial, October 18, 1825. See also the *Address* of the Committee of the Harrisburg Convention, 15–16.
[7] Editorial, February 3, 1826.
[8] See above, p. 43.
[9] *Internal improvement—No. 2. Railways and canals,* 2.
[10] *Pittsburgh Gazette,* July 7, 1818, quoted in Livingood, *op. cit.,* 20.
[11] *Address,* 12.
[12] "Northumberland," *U. S. Gazette,* September 22, 1825.
[13] "Extract of a letter from a gentleman of this city to a Western member of the Legislature, dated February 23, 1825," *U. S. Gazette,* March 7, 1825.

more panic-stricken than the others? I believe this was so, but find it very difficult to demonstrate.[14] In any case, all three areas were justified in considering the situation to be urgent.

However, there was one aspect of mainliners' attitudes that did not exist in the other two areas and that, when taken in conjunction with the general feeling of panic, can provide a plausible explanation of the refusal to postpone. A belief prevailed among them that if they delayed they would lose an opportunity that might never recur. They believed that it was the immediate drama, the spectacular success, of the Erie Canal that had provided them with the opportunity to overcome the great power of anti-mainline sentiment in the state. "The people are ripe for it," wrote a Philadelphian who opposed railways, "there is a general excitement; and if this be suffered to expire, no one can tell when so favorable an opportunity will again present itself." [15]

It is true that powerful sectional forces opposed the concentration of the state's resources upon a single interregional line. Lancaster county was content with its turnpike to Philadelphia; Lehigh, Lebanon, Perry, and Union counties felt that the Susquehanna River, the Union Canal between the Susquehanna and the Schuylkill, soon to be completed, and the Schuylkill Navigation to Philadelphia would be adequate to their needs. Other areas had developed "foreign" allegiances: along Pennsylvania's southern border, farmers marketed their produce in Baltimore or in the neighboring counties of Maryland and Virginia; in the northeastern section of the state they traded with New York. It was in reaction to the tendency of these sectional interests to scatter the resources of the state on local projects that the term "mainline" was adopted for Pennsylvania's answer to the Erie Canal.[16] However, the mainliners complained of the long record of postponement, not only of the line to the west, but of other canal projects as well. Carey later pointed out that even the Chesapeake and Delaware Canal project—much less costly and risky than the mainline—had long been dormant. "At length the noble example set by the Erie and Hudson Canal, aroused the energies of our citizens, which had been so long, as regarded canals, entirely torpid." [17]

Consequently, the image of Pennsylvania as a sleeping Samson—"While we slept our locks have been shorn"—had some justification.[18] Another canaller explained railroad agitation in Pennsylvania in this fashion: assume, he suggested, that a man who has slept long and deeply is suddenly awakened to a situation of great danger. Such a man, in desperation, would be liable to great error in his choice of means. This was Pennsylvania's case, he believed; this explained advocacy of so strange a thing as a railroad.[19] The image was apropos; to the present reader it could better explain advocacy of so strange a thing as a canal over mountains.

Thus, it was the strength of the opposition to the mainline—a strength that in the mainliners' view had crippled the state improvement movement for years and could easily do so again—that evidently explains the now-or-never attitude of the mainline leaders. It was this attitude, together with the great fear of the projects of the competing states, that accounts for the fact that the railroad was considered so dangerous a threat to mainline aims. For the mainline was considered to hang by a thread, while the railroad issue was divisive; and delay meant the end of any mainline project, while serious consideration of the railroad inevitably involved delay. Carey remarked that there was "so much opposition from so many quarters, and on such a variety of grounds" against a mainline that this additional issue "will afford incalculable advantages to those who oppose this grand measure in every shape and form." [20] Other improvement advocates agreed.

> If there is as much difference of opinion, and as strongly contested, when the subject is brought before the legislature, . . . I fear we will be disappointed in seeing either a railroad or a canal for a long time. . . . Amidst all the obstacles and difficulties it will have to encounter in the Legislature, this will most probably be the worst.

The great question was, *"whether a grand plan of internal improvements shall not be commenced forthwith."* [21]

This attitude had little to do with the much-debated technical characteristics of the railroad as compared to the canal. "I am not by any means an opponent of railroads or of any other improvement that the progressive lights of the age may suggest . . . ," wrote a Philadelphian. But "if at this moment we permit our attention, or the public opinion, to be distracted to railroads, or any other supposed improvements, we shall fail in both plans. . . ." The important thing was speed, "before the commerce has acquired the correspondences, and habitudes that are so difficult to break." [22]

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[14] A perusal of a great deal of improvement propaganda in all three areas has convinced me that Pennsylvania did react much more sharply to the threat of the Erie Canal than did the others. But I cannot demonstrate this because they all made some extreme statements. That Massachusetts and Baltimore propaganda was, on the average, calmer and more realistic would be demonstrated, I believe, by a content analysis of the literature.

[15] "Extract of a letter from a gentleman of this city to a Western member of the legislature . . . ," *U. S. Gazette,* March 7, 1825.

[16] See Bishop, *op. cit.,* 184–185.

[17] *Brief view,* 12.

[18] See above, p. 49.

[19] "Northumberland," *U. S. Gazette,* September 22, 1825.

[20] *Internal improvement—No. 1. Railroads and canals,* 1–2.

[21] "Amicus," *U. S. Gazette,* November 28, 1825.

[22] "Extract of a letter from a gentleman of this city to a Western member of the Legislature . . . ," *U. S. Gazette,* March 7, 1825.

This belief in the strength of the opposition to the mainline had another important consequence, one that has dramatically distinguished Pennsylvania's improvement program from those of Massachusetts and Maryland. It forced the leaders of the improvement movement to drop their announced policy of concentrating all energies on the long-range east-west line. They promised branch lines in return for mainline votes and in building those branches considerably delayed the completion of the mainline. In the east, canals totaling 273½ miles were built north from the mainline along the Susquehanna and its north and west branches, and a sixty-mile Delaware Division connected Bristol above Philadelphia to the coal trade of the Lehigh valley. In the west, 112 miles of canal, aided by a fifty-mile canal feeder to provide more water, connected Beaver on the Ohio above Pittsburgh to Lake Erie.[23] The leaders of the improvement movement regretted the effects of this policy but, as with the refusal to postpone the decision, they believed that any other policy would end all hope of a mainline for Pennsylvania. Carey, for example, stated in 1827 that the policy of supporting branch lines in return for mainline votes was

> the only one that afforded a reasonable prospect of success —that is, consulting the interests of the different great sections of the state, and letting them advance *pari passu*. . . . Any other system would be as impolitic as unjust. . . .[24]

Two and one-half years later Carey referred to the simultaneous construction of branch lines and mainline as one of the principal causes of Pennsylvania's financial difficulties.[25] But while regretting the results of the policy, he continued to justify its necessity: the minority opposed to the mainline was so large that alienation of only a few votes would have wrecked the project.[26]

In the mainline leaders' view, therefore, they had little, if any, room for maneuver. The strength of the opposition made it impossible to postpone construction and therefore ruled out the full railroad; and the strength of the opposition necessitated the branch-line deals. This view assumed that the opposition would not be influenced by the characteristics of the mainline proposal because it was motivated solely by sectional interest and by prejudice against all improvements. Historians have tended to accept this view; they have implicitly assumed that there was no question of poor leadership involved because the leadership had no choice. Both Avard L. Bishop in his *State Works of Pennsylvania* and Louis Hartz in his *Economic Policy and Democratic Thought: Pennsylvania, 1776–1860* completely ignored the railroad-canal debate of 1825. This eliminated one important choice. And Hartz, in stressing the contradictions inherent in the theory of regional self-interest, has given the impression that, aside from prejudice against improvements in general, it was sectional and vested interests alone that determined the strength of the opposition to the mainline proposal.[27]

There is evidence, however, for a different view. If the strength of anti-mainline sentiment was determined, not only by prejudice and sectional interests, but also by the real disadvantages of the proposed canal over the mountains, then postponement and a subsequent proposal of a full railroad might well have mitigated the opposition to the mainline. A stronger mainline movement might then have been able to avoid the branch-line policy. The question is worth investigating; certainly the opinions of the mainline leaders as to the sources of anti-mainline sentiment cannot be taken for granted as accurate. The fact that the failure of the mainline was a result of its natural disadvantages —a fact that Hartz has noted—should by itself cast doubt on the contention that only prejudice and sectional interest caused the opposition to the mainline. For these disadvantages were clearly visible in 1825 and it is difficult to believe that opinion in Pennsylvania was not strongly influenced by these overwhelming geographic factors.

Most of the evidence for this influence has to be extricated from anti-mainline pronouncements that indicate a complex mixture of motives. Two long anti-mainline speeches at the Harrisburg Convention raised the following arguments against proceeding with any mainline: (1) There was insufficient evidence of the practicability of the project—four routes had been proposed for the canals, but not one had as yet been sufficiently explored. (2) The estimated cost of tunneling through the summit was ludicrously small. (3) The expense of the canal was uncertain, but it would certainly not be less than $10 million. (4) The finances of the state would not allow so expensive a project—they were against borrowing money for risky experiments. (5) The majority of the population either opposed the project or were lukewarm toward it.

Despite all these objections, the speakers urged, not the scrapping, but the postponement of the mainline. Postponement, they claimed, would provide time to gather sufficient information on the routes, thereby reassuring the population. Furthermore, the people would be influenced in favor of a mainline if the Union Canal, scheduled to open in the summer of 1827, were a success. Finally, postponement could do no harm because surveys, estimates, and plans would require

[23] See Hartz, *op. cit.*, 148–149; Bishop, *op. cit.*, 186–187, 190–195, 199–204, and map opp. 96.

[24] *To the citizens of the commonwealth of Pennsylvania; internal improvement, 1*, signed "M. C., Philadelphia, March 6, 1827," n.p., n.d.

[25] The other cause he mentioned was the neglect to make specific and adequate provision for the payment of interest on the loans. See *Internal improvement*, dated November 12, 1829, signed "Hamilton," *passim*, n.p., n.d.; and *Internal improvement. No. 2*, dated December 5, 1829, signed "Hamilton," n.p., n.d., *passim*.

[26] *Brief view*, 16–18.

[27] See pp. 14, 134–136, 292.

eighteen months to two years in any case. They favored continuation of the current Board of Canal Commissioners for these purposes.[28]

Clearly the motives were mixed. There was the conservative financial argument against any large project and there were the specific arguments applicable only to the particular mainline proposal. In the midst of citing all the above arguments, one of the speakers, James M. Porter, interjected that once all the routes were thoroughly examined, "he would go heart and hand with the gentlemen who advocated a grand canal. . . ." The other speaker, N. H. Loring, added to the above arguments a panegyric of internal improvements:

> Blind must he be indeed . . . who does not perceive the immense wealth . . . which a successful prosecution of the canal policy will give to this commonwealth. . . . On this subject we should not solely calculate the profit and loss. . . . Canals and roads . . . will be the arteries of our political existence. . . .

Thus, not all of the opponents of the mainline were the blind reactionaries portrayed by their more literate and influential Philadelphia opponents; nor were they all motivated by local interest. On the contrary, the real problems involved in a mainline canal, and the haste and lack of clarification of technical issues, made many conservatives wary of a venture which in other respects may have appealed to them. The realism of the anti-mainliners is sometimes striking; no more accurate contemporary analysis of the real factors involved in Pennsylvania's attempt to compete with the Erie Canal was produced than the following anti-mainline pronouncement:

> The advocates of a grand canal in this state have, in taking the New York canal as the basis of their calculations, entirely overlooked its peculiar advantages. The Clinton canal . . . traverses a country so level that the amount of its lockage does not much exceed the height of Lake Erie above tide water—passes at right angles to the course of numerous rivers that flow from the south, is consequently easily and abundantly supplied with water—possesses along its whole extent a fine wheat country—terminates in Lake Erie, and thus connects an immense inland navigation with the ocean at the city of New York, the commercial depot of America. A canal through Pennsylvania would have nothing in common with this, excepting its termination in Lake Erie. How far it might compete with others for the trade of the lake, may in some measure be estimated by the fact that before it could advance fifteen miles from the lake, it would require a lockage equal to the whole of that of the New York canal. . . . Our state possesses many natural advantages—let us improve them. We will certainly fail to compete with the State of New York for the trade of the West. Nature has given her advantages in such a competition which we cannot overcome.[29]

Mainline propaganda attributed such views to narrow prejudice and selfish interest. But the pessimism of the writer could be overcome only by the future development of the railroad.

MANIA VERSUS THE MOUNTAINS

The analysis thus far has proceeded in terms of the real problems confronting the improvement leadership of the state and its sincere reactions to those problems. Certain aspects of the debate, however, raise questions as to the motivations and the psychology of that leadership. There was, for one thing, a puzzling contradiction between the real prospects of the mainline, described so convincingly by the opposition, and certain manic characteristics of mainline agitation. One would expect that the state's obvious difficulties in a canal competition with New York would have at least moderated the optimism; instead it went far beyond anything found in Baltimore and Massachusetts. Although all the rivals of New York developed improvement movements that made confident and at times unrealistic assertions, only in Pennsylvania do we find a movement so intense that real difficulties were, in effect, abolished and logic itself distorted by its responsible leaders. The fundamental difficulty was of course the crossing of the Appalachian mountain range; in relation to this problem, all these curious aspects of mainline agitation appeared in their most extreme form.

It was noted above that acceptance of a portage railroad contradicted a good many of the technical arguments against a full railroad, but that nevertheless it was referred to favorably quite early in the debate. It had many advantages. For one thing, it did not conflict with the dominant canal mania, while it permitted a gradual adaptation to an entirely new idea.[30] Secondly, the auxiliary railroad presented important political advantages. The geographic flexibility of the railroad made it possible to promise auxiliary lines—railroad or canal—to every section of the state, even to those without a water supply, in return for support of the mainline.[31] Thirdly and most importantly, it literally saved the canal mainline project. Long consideration of the February proposal of the majority of the Canal Commissioners for a tunnel under the summit had resulted in some grave doubts. Even if the tunnel could be dug within a reasonable time—which was highly unlikely—that water supply at the tunnel level would probably be insufficient. Canal advocates admitted this.[32] The only alternative was a portage—by wagon on a common road or by railroad. A road-and-wagon portage might have appealed to conservatives who believed in doing only what had been done

[28] Speech at the Harrisburg Convention by James M. Porter of Easton as reported in *U. S. Gazette,* August 11, 1825; and by N. H. Loring, as reported in *U. S. Gazette,* August 26, 1825.

[29] Quoted in Bishop, *op. cit.,* 182–183, from the *Harrisburg Chronicle* of March 10, 1825, which had copied it from the *Erie Gazette.*

[30] On the persistence of the conception of the railroad as a mere auxiliary, see Van Metre, *op. cit.,* 59.

[31] See "Bridgewater," *U. S. Gazette,* March 11, 1825; "Dexter," *Poulson's,* March 14, 1825; "New questions," *Poulson's,* December 28, 1825.

[32] See "Northumberland," *U. S. Gazette.* November 2, 1825.

before, but it would have meant that the most difficult part of the mainline route would have depended upon the transportation method of the eighteenth century. The auxiliary railroad could not possibly be avoided.

With these considerations in mind, it is instructive to examine the chronological development of mainliners' attitudes towards the auxiliary railroad during the debate. In February of 1825, Mathew Carey's greatest objection to the use of the railway in Pennsylvania was the great elevation it would have to overcome.[33] Less than six weeks later he felt that railways might be found preferable to canals, particularly in mountainous regions.[34] In May, on the other hand, another canaller returned to the seemingly more logical view that, while short railroads in level country which were "subsidiary to canals" would probably be useful, it was doutbful that they could be built over "our rough and distant mountains." [35]

In September, the portage proposal was subjected to a scathing attack by a canal advocate who was taking a prominent part in the newspaper debate. "Northumberland" asserted that the portage railroad imposed the very disadvantage that, in his view, ruled out the full railroad. No westerner, he contended, would accept the delay and spoilage of goods that would be involved in transshipping his goods from his Ohio River boat to a full railroad at Pittsburgh if he had any navigable alternative; and the alternative would be there, for he would be able to proceed by boat, either to New York or, by the projected Potomac Canal, to Washington or Baltimore. If this ruled out a full railroad, "Northumberland" contended, then it ruled out to an even greater degree a portage railroad that would require two transshpiments. Only a full canal, he concluded, could possibly compete successfully with the Erie and with the proposed Potomac Canal.[36]

While one canaller thus forecast the competitive failure of a mongrel line, others raised seemingly decisive technical objections to railroads over mountains. In September, "H" ridiculed the method of inclined planes and stationary engines advocated by Strickland; in October, Carey, contradicting himself again, ignored the inclined-planes method and contended that the locomotive's inability to handle steep grades ruled out the railroad in mountainous areas.[37]

Nevertheless, a portage was an unavoidable requirement of the canal project, and, in December, Carey finally conceded that important objections to the mainline—enormous aqueducts, tunnels, and many hundreds of locks—could "easily be removed" by acceptance of a twenty- to twenty-five-mile portage. He admitted that people who "delight in finding difficulties and starting objections" considered transshipment an insuperable bar. But produce shipped on the Ohio and intended for New York, he pointed out, had to be transshipped to sloops at Lake Erie, to canal boats at Buffalo, and again to sloops at the Hudson. A mainline with a portage would require only two transshipments.[38] A few weeks later, Carey conceded that the portage might be a railroad using locomotives for the levels and inclined planes and stationary engines for the inclines.[39]

Judging from the numerous contradictory postions taken by canal advocates, acceptance of the portage railroad was a reluctant adaptation to ineluctable necessity. Furthermore, Carey's acceptance of the railroad portage came very late—a month before the canal decision—and even then was only conditional: it could be a railroad, he wrote. There was good reason for his vagueness. By dropping the Canal Commissioners' tunnel proposal midway in the debate; by substituting the word "portage," without definitely stating whether it would be a road or rail portage; and then by confining his cost estimate to that for a canal from the Susquehanna to the Ohio, excluding the extremely expensive twenty- to thirty-mile portage, he could come up with a cost of $20,000 per mile, or $5,400,000 for the line. The estimate was too low—lower than the actual per-mile cost of the Erie Canal—but it was not completely unreal because he was omitting the most difficult mountain section (as well as the Philadelphia-to-Susquehanna River section).[40]

Because of this vagueness before the decision, the canal advocates never had to discuss extensively with their opponents either the problem of multiple transshipments in case of a portage or the delay and expense to shippers that would be caused by the huge amount of lockage on an unbroken canal. In January, 1826, when Carey was conceding the necessity of a portage, his pro-railroad opponents were concentrating on the difficulties of tunnel construction.[41] A month later, the Pennsylvania Committee on Inland Navigation and Internal Improvement issued a report—the report that led to the mainline bill of February, 1826—which implicitly assumed a full canal. The completed mainline, the Committee asserted, would be preferred even by New York merchants trading with the Ohio River valley. For not only would they save some two hundred miles, but they would avoid the two trans-

[33] See "Canals and railways—No. 4," in *U. S. Gazette,* February 16, 1825.

[34] See "Canals and railways—No. 6," in *U. S. Gazette,* March 28, 1825.

[35] "A. Z.," *Poulson's,* May 3, 1825.

[36] *U. S. Gazette,* September 22, 1825.

[37] See above, p. 32.

[38] *Internal improvement—No. 4. Railways and canals,* 1. Actually it was generally realized that, owing to the narrow locks of the Union Canal, either a transshipment would also be required at the Susquehanna River or an entirely new canal would have to be built in the difficult Philadelphia-Susquehanna River area. The February, 1825, report of the majority of the Canal Commissioners had recommended the building of such a canal; in March, 1828, the legislature provided for construction of the Philadelphia-Columbia Railroad.

[39] "Letter to Alnus," *U. S. Gazette,* January 10, 1826.

[40] See above, p. 36.

[41] See "Alnus," *U. S. Gazette,* January 3, 1826.

shipments necessary on Lake Erie.[42] The Committee carefully avoided explicit statements on both the route and the portage issues, and the legislature followed suit in its decision to authorize construction only of those canal segments common to all the routes.

It was a year later, in February, 1827, that a state legislative committee finally took cognizance "of the opinion entertained by many respectable persons that the great amount of lockage on the canals in Pennsylvania, will prevent their coming into succesful competition with New York for the trade of the west." The committee disagreed: Pennsylvania was over one hundred miles closer to Lake Erie than was New York; costs would be less because of the advances in building techniques since construction of the Erie; the Pennsylvania climate would make possible a longer season of navigation; and even the amount of lockage was no problem because a report of the United States Board of Engineers had shown that if the canal were made one foot deeper and eight inches wider than the Erie, then, despite the greater lockage, "the same tonnage may be transported in less time, with less power, hence more cheaply. . . ." [43]

There was a curious lack of logic in those arguments that dealt with the problem of the mountains. Since the deeper and wider a canal, the less the resistance of the water to a boat's passage, the Committee reasoned that the disadvantages of crossing mountains by means of locks—huge initial cost of construction, greater maintenance cost, and slower time of passage—could be made up for by an additional huge capital expenditure on construction of a canal wider and deeper than the Erie! The argument might be taken to indicate an implied assumption that the capital cost of the project was not to be considered a factor in determining the cost of transportation on the line if not for the constantly reiterated assertions that construction costs on the Pennsylvania canal would be equal to or below those on the Erie. "Such is the favorable nature of the ground in Pennsylvania," wrote the above-cited Committee, "that the average cost per mile, including lockage, will not be much more than half the cost of the canals of New York, with which they are determined to enter into competition. . . ." [44]

This habit of ignoring the principal difficulty in the way of Philadelphia was an old one, extending back to the period when New York's project first appeared as a serious possibility. In 1808 Albert Gallatin, then Secretary of the Treasury, wrote a report on public roads and canals which recommended an east-west canal only for New York. He pointed out that the most elevated lock canal known to him was the one in Languedoc, which reached 600 feet above sea level, while the Alleghenies, according to his information, were about 3,000 feet above the sea and the most advantageous passes could not be sufficiently below this level to make a canal practicable. He further pointed out that as the height of lock navigation increases, a proportionately greater supply of water is required, while the available water diminishes. "Nor does the chain of mountains, through the whole extent, where it divides the Atlantic from the western rivers, afford a single pond, lake, or natural reservoir. . . ." Gallatin therefore suggested improvement of the eastern rivers to the highest possible point, then a connection by roads to the western rivers. He recommended a canal to the west only where the mountains could be avoided, that is, through New York State's Mohawk Valley.[45]

These were evidently decisive objections to a canal over the mountains. Nevertheless, in an indignant series of letters, a prominent member of the Pennsylvania legislature, William J. Duane, asserted that a Pennsylvania canal was not only possible, but easily and cheaply accomplished: "I am of opinion that a perfect water communication between the Pennsylvania Atlantic tidewater and the lakes might be opened for one half the sum defined [in the Gallatin report] for New York." [46] The remarkable thing about this type of assertion is that a difficulty, a disadvantage, is magically transformed into its opposite. To Gallatin's assertion that only New York could avoid climbing the mountains, Duane's answer was not the expected one—that Pennsylvania could do it too despite disadvantages—but that Pennsylvania could do it more easily. By 1825 this type of answer was legion:

> . . . we shall surpass all the others; our lines will be the shortest, and will lead more immediately to the seaboard. We shall also have less lockage, so that the delay in passage will be less . . . [the mainline from the Susquehanna to Pittsburgh] will not cost more than $1,200,000, if properly located and well managed. . . .[47]

[42] See *Niles' Weekly Register* **29**: 407, February 18, 1826.

[43] Pennsylvania House of Representatives, Committee on Inland Navigation and Internal improvement, *Report*, read in the House on February 28, 1827, in Pennsylvania House of Representatives *Journal* **2**: 624, 1826–1827.

[44] *Ibid.*, 615. The Committee was evidently referring to the October 1826 report of the U. S. Board of Internal Improvement on the Chesapeake and Ohio Canal. The very high cost estimates in this report shocked the supporters of the project, who called the second Chesapeake and Ohio Canal Convention for December, 1826, to demand a new investigation. The committee of that convention praised the U. S. Board for its scientific ability, especially in regard to the above-mentioned theory that an increase in a canal's prism could make up for a great lockage, but felt that it simply could not afford the large prism. See Chesapeake and Ohio Canal Convention, *Proceedings . . .*, 48–49, Washington, 1827.

[45] Gallatin, *op. cit.*, 22–23, 37–38. On page 38 he also suggested the practicability of turning the mountains to the south through Georgia along the Chatahoochie and Mobile rivers to the Gulf of Mexico, but did not include this project among his proposals to Congress.

[46] *Letters addressed to the people of Pennsylvania . . .*, 50, Philadelphia, 1811. These letters, signed "Franklin," originally appeared in the *Aurora* between August and December, 1810.

[47] "Extract of a letter from a gentleman in this city to a Western member of the legislature, dated February 23, 1825,"

Though the more authoritative statements did not explicitly claim less lockage for the Pennsylvania canal, they were equally euphoric. ". . . we have unquestionably the best route for a canal between the eastern and western waters," wrote the majority of the Canal Commissioners to the Governor in November, 1824.[48] This "best" route became the "cheapest and best route" in the Governor's annual message the next month.[49] It was this ability to ignore a mountain range that led Carey to the remarkable assertion that ". . . the Pennsylvania canal will have immense advantages over the Erie. . . ." For without those mountains, the advantages he stressed so much—mineral deposits and a central position—might well have given Pennsylvania the first position in the western trade.[50] It was on this basis that the Society's Acting Committee could predict that a Pennsylvania canal would draw all the interregional trade of a wide band of territory centering approximately on the Ohio River and going beyond it. This hinterland would include one-half of Ohio and Kentucky, part of Indiana and Illinois, all of Missouri, and the northwest section of Virginia—an area with a population of 1,020,000. All that remained for the Erie Canal, asserted the Committee, was the other half of Ohio, part of Indiana and Illinois, Michigan and the Northwest territory, and part of Canada—an area having a mere 410,000 population. Thus, "though it may at first appear doubtful," the benefits of a canal to Pennsylvania would far exceed the benefits of the Erie to New York.[51]

The remarkable thing about all this unrealistic optimism was that it coincided with far more realistic attitudes. When the Committee of the Harrisburg Convention justified state rather than private construction, two reasons were presented. First, private individuals could not command sufficient capital for so large an enterprise; secondly, "the advantages are too numerous and important to be surrendered into the hands of any individuals." [52] But when John Sargeant of Philadelphia explained to the Harrisburg Convention the need for state rather than private construction of the mainline, he referred to the losses incurred by private capitalists in the building of the Philadelphia-Pittsburgh and other turnpikes and maintained that the "same ruin" would be in store for the private corporation that would build an east-west canal, unless it avoided construction of the more difficult sections and thereby frustrated the principal object of the project. "The public good," he said, "ought not to be advanced at the expense of individuals." [53] Thus did euphoria coexist with hard-headed realism in the mainline movement.

VESTED INTERESTS

What is the relationship between all these excesses, contradictions, and obfuscations in the agitation for a mainline and the decision for immediate construction of a canal? The simplest hypothesis would be that the falsification was deliberate; that the mainline leadership was dominated by groups whose interests differed from those of the state.[54] John Stevens, for example, charged that a crucial factor in the opposition to the early railroads was the belief of canal proprietors that railroads would harm their interests.[55] Presumably, the proprietors of the Union Canal, expecting that their line would become, at least temporarily, the eastern section of a canal mainline, were opposed to a railway mainline that would either bypass their canal or stop at the Susquehanna River and force a transshipment of freight to the canal—thereby tempting traffic to turn down the Susquehanna to Chesapeake Bay.[56]

This vested-interest charge was raised during the debate. A leading railroad advocate, "Examiner" (the

U. S. Gazette, March 7, 1825. The Erie Canal cost over $7 million.

[48] Letter from Holgate and Clarke to Governor John A. Schulze, November 3, 1824, in Pennsylvania House of Representatives *Journal* 2: 330, 1824–1825.

[49] In *Pennsylvania Archives, 4th ser.* 5: 548–549.

[50] See *Internal improvement—No. 4. Railways and canals, passim.*

[51] "To the citizens of the commonwealth of Pennsylvania," in *U. S. Gazette,* March 22, 1825.

[52] *Address,* 16.

[53] Quoted in *Niles' Weekly Register* 29: 61, September 24, 1825. Hartz, *op. cit.,* 139–142, discusses the fact that the mainline leaders justified state construction both because there would be great profits which ought to go to the state and because there would be losses which should not be borne by individuals.

[54] Some years later, evidence was turned up that indicates, not necessarily that the mainline leaders of 1826 deliberately distorted facts about the mainline, but that such distortion was much more likely in those days than is generally assumed. In 1833 a Pennsylvania legislative committee investigating the great disparity between engineers' cost estimates and final costs on the state's canal and railroad system found two important causes. One was "the great haste and inaccuracy with which the original surveys were made. . . ." The other cause is much more interesting: "It has been proved to the committee, that the estimate of the cost of at least one branch of our canal improvement, made by the engineer, was by him reduced to one-half the amount ascertained by his calculations, because, as was alleged, the work would never be authorized, if the true estimate was made known to the Legislature." This had been done under a previous Board of Canal Commissioners, according to the Committee. See *Report of the grand committee on the canal and railroad system,* in Pennsylvania House of Representatives *Journal* 2: 749, 1832–1833. On the general likelihood of such distortions, see Hartz, *op. cit.,* 156–157.

[55] Gregg, *op. cit.,* 316. See also the summary of the letter from Stevens to William Lehman, dated February 5, 1826, numbered S6780–S6781 in the Work Sheets of the Works Progress Administration Project of the Stevens Family Papers, handwritten, in Stevens Institute of Technology, Hoboken, New Jersey.

[56] *Cf.,* however, Livingood, *op. cit.,* 110: "The railroad was not feared as a competitor of the Union Canal by canal-believers who had no faith in railroads." On its completion in 1834, the Philadelphia-Columbia Railroad did carry much of the through western trade, and large quantities of freight did turn down the Susquehanna to Chesapeake Bay.

author of *Facts and Arguments,* according to Carey), discerned a small group in the mainline movement with lands on the banks of the Susquehanna and Allegheny rivers who knew that a canal would pass through or near their lands while a railroad would not.[57] Another defender of railroads discerned a larger special-interest group in those non-mainline areas that were pressing for canal feeders and river improvements. According to "Alnus," the population in these areas assumed that the railroad party was opposed to all navigable improvements, mainline or non-mainline. He tried to reassure them: railroad advocates were very much in favor of the improvement of the Susquehanna, for example, for it would increase the traffic on a mainline railroad.[58]

There was also a statewide interest that might be placed in the "vested interest" category. According to a canal advocate, the entire state network of local canals and improved rivers could be "ruined" by a decision in favor of a railroad. For if the leading communication through the state was a railroad, all its connecting lines leading to every part of the state would have to be railroads as well; otherwise a "mass of confusion" would inevitably occur at every junction with a water communication.[59]

Put in this way, the vested canal interest involved, not merely petty individual profit-and-loss, but a large previous investment in canals and improved waterways by the state, by localities, and by individuals.[60] But the importance of this factor is open to doubt. Canal advocates, in the heat of debate, naturally wrote of the "ruin" of the entire navigable system. Actually the disadvantages of the transshipment at the points of intersection with the mainline railroad would not have eliminated the advantages of these waterways in their local areas. On the mainline, for example, the through traffic suffered from the disadvantages of transshipment because of the existence of competing all-water routes, but local traffic could use no other lines. It is true that investors in some of these local waterways might have feared that future local railroad construction and competition would be aided by the existence of a mainline railroad. But this possibility did not endanger the interests of the state as a whole: Pennsylvania's waterways system would not be suddenly ruined, only gradually replaced. Furthermore, anyone who took seriously in 1825 the possibility of railroad competition in areas already supplied with navigable waterways had unusual faith in the future of the railroad. Finally, it is impossible to ignore the overwhelming evidence that the leadership of the mainline movement was open-minded on the railroad question in the period before the arrival of the Strickland report. Strickland's mission itself is evidence of this impartiality.

There was, finally, a much more powerful special interest than any yet discussed. Philadelphia, Pittsburgh, and other towns on the route of the proposed canal would harvest the major portion of the benefit from the mainline while the cost would be borne by the state as a whole.[61] It was to them that the extreme form of the economic development argument applied: any line was bound to be advantageous. Their representatives, like John Sargeant of Philadelphia, could afford to be realistic about the financial prospects of the mainline. To the extent that the mainline leadership reflected primarily the commercial interests of Philadelphia—and the history of the Pennsylvania Society indicates that it did—it would not consider a financial loss to the state a very serious matter as long as Philadelphia could obtain the trade of the west. But this factor does not explain the refusal to postpone the decision. It should have been as evident to Philadelphians as to other Pennsylvanians that the railroad would soon be tested and might confer larger benefits than a canal: Philadelphians, like other Pennsylvanians, committed a serious error in 1826.

SUMMARY AND CONCLUSIONS

It is time to sum up our rather long analysis of the Pennsylvania debate. We began with the investigation of the technical aspects of the railroad in comparison with the canal. That investigation revealed many advantages and no definitive objection to the new technique. However, in contrast to the widespread use and the great New York success of the canal method, there had been insufficient experience with the general-purpose railroad to justify a large-scale project. Related to this situation, but certainly not justified by it, was the tendency to consider any canal to the west to be certain of success. At this point we meet with the first peculiarity of agitation for the mainline: its remarkable dependence upon a crude and unrealistic analogy with the New York situation.

An interregional railroad, on the other hand, was correctly considered to be a risky step into the unknown. There was, however, good reason to delay the decision until the completion of the currently-planned English railroad projects would supply the necessary tests. That the mainline readers refused to postpone was attributed to panic concerning Pennsylvania's competitive position, combined with their belief that, in view of the strength of anti-mainline sentiment in the state, the dramatic success of the Erie had given them their only opportunity to obtain state construction of any line to the west. Here again there was a feeling of utter dependence upon events in another state.

With postponement ruled out, with the railroad experience so meager, and with a conservative opposition to the mainline that would apparently be strength-

[57] *U. S. Gazette,* December 12, 1825.
[58] *U. S. Gazette,* December 30, 1825.
[59] "Northumberland," *U. S Gazette,* September 22, 1825.
[60] For a review of these projects, see Bishop, *op. cit.,* 150–164.
[61] See Hartz, *op. cit.,* 140–141.

ened by adoption of a radically new technique, there seemed to be no choice but to try to build a canal over the mountains. Since the disadvantages of the method were many and obvious, this policy of immediate construction must have greatly increased the very opposition that the improvement leaders were trying to minimize.

These problems may explain in part the fantastic elements in the agitation for the mainline—the extreme optimisim and the elimination of difficulties. Another explanation, that of the dominance of special-interest groups, is neither satisfactory nor necessary. It is quite possible that those exaggerations and distortions were considered necessary to put over a project that the leaders believed was in the interests of the state. However, as was noted above, the use of such tactics went far beyond what was considered necessary in Baltimore and Massachusetts. Evidently the improvement leaders—that is, primarily the merchants of Philadelphia—lacked confidence in their ability to influence the population of the state on an open basis. The most striking evidence for this is their pessimistic assumption that a mainline bill could pass the legislature only under the immediate influence of a dramatic success in another state. Thus, Pennsylvania's errors may be related to historically determined elements in the state's structure: the strong regional interests outside Philadelphia, the western political antagonism to the principal commercial city, perhaps even the tensions between the Quakers and the rest of the population. The canal decision was, after all, a political one, and its full analysis would require a study of the state's political and social as well as economic structure—a study that is beyond the scope of this paper.[62]

There are a number of striking contrasts with the case to be taken up in the chapters on Baltimore. There, a group of merchants favored an interregional railroad before its thorough testing in England; and there, as will be seen, the willingness of those merchants to invest their capital allowed them to shape public opinion rather than to try to adapt to it. Furthermore, despite the atmosphere of mania that enveloped the inception of the Baltimore and Ohio railroad, there was far greater realism in regard to the crucial problem of the mountains, a realism that was apparently made possible by a calmer, more confident attitude towards the prospects of the project. In Pennsylvania, on the other hand, despite all the euphoric statements, one gets the impression that the canal advocates were, underneath it all, unsure of the outcome. Indeed, their utter dependence on the Erie Canal analogy gives an impression of desperation, the kind of desperation that is provoked by knowledge of immense natural disadvantages. Only desperation can account for the unrealistic exaggerations and extreme analogical arguments with which they justified that technological monstrosity, a canal over mountains. And when their project met with powerful opposition, partly because of its disadvantages, they agitated in desperation for immediate action. In desperation, they repudiated the report of their own railroad investigator, ignored the clear signs of technological progress in the railroad field, glossed over the technical difficulties, and plunged ahead with their canal at the beginning of the railway age.

V. AFTER THE DEBATE

FROM MAINLINE CANAL TO PENNSYLVANIA RAILROAD

With the convening of the legislature in December, 1825, the great debate reached its final and decisive phase. Governor John A. Schulze's annual message reflected the widespread doubts of a canal policy and emphasized "the advantages to be gained by waiting for full and perfect information before any irretrievable steps should be taken. . . ."[1] But those irretrievable steps were recommended to the legislature the following February in the report of the new Board of Canal Commissioners (appointed the previous April). The Board rejected two of the previous Board's recommendations: it proposed a shorter route and it suggested a railroad portage instead of a tunnel. But the work could be started without settling these issues immediately; the Board urged the legislature to proceed with those canal sections that were not in the mountains and that were common to all the routes under consideration. These consisted of a canal along the Susquehanna between Middletown and the mouth of the Juniata, and another along the Allegheny between Pittsburgh and Kiskiminetas Creek. The Union Canal, which was scheduled to begin operation in the spring of 1827, would temporarily connect Philadelphia to the mainline. It was assumed that a larger, more direct canal would be built in that area sometime in the future.[2]

[62] Relevant too would be a study of the effects of differences between Philadelphian and other merchants. Livingood, *op. cit.*, 2, quotes John Melish's *Travels in the United States of America in the years 1806–1807 and 1809–1811*, 2 v., Philadelphia, 1812, who remarked that the city was dominated by Quakers who had "given a tone to the manners of the people different from what is to be found in most places of equal extent. They are industrious and sober, and, though sufficiently commercial, they do not conduct their business in the same *dashing* style which is done by some commercial cities; but confine themselves within bounds, and secure what they gain." Much of the material in Livingood's book seems to bear out the assumption of an unusual degree of passivity and fatalism among Philadelphians. But this must remain a highly speculative subject without comparative investigations of Philadelphia's behavior with respect to many improvement projects and in many other fields.

[1] In *Pennsylvania archives, fourth series* 5: 590–593.

[2] Report . . . read in Senate, February 7, 1826, Harrisburg, 1826, *passim;* Pennsylvania Society . . . Acting Committee, *The Union Canal. Paper read at a meeting of the acting committee*, 1, n.p., n.d., dated August 26, 1826.

The legislature agreed with the Canal Commissioners; a bill for the construction of fifty-four miles of canal at both extremities of the mainline route passed by a vote of 19 to 14 in the Senate, 65 to 23 in the House. It was signed by the Governor on February 25. The route issue and the portage problem were left open. To the criticism that it was premature to begin construction of segments before the entire project had been decided upon, the House Committee on Inland Navigation and Internal Improvement replied that the segments would be valuable as independent canals. Their utility would outweigh their cost, the Committee asserted, "even if no extension of the line of canal should ever take place." [3] The fact that the construction of canal segments ruled out the full railroad was not mentioned. Construction was begun on July 4, 1826. Governor Schulze's annual message the following December reviewed the various improvements in progress without referring to the recommendation for postponement in his message of the previous year.[4] The railway-canal debate was over.

But the determination of the form of the mainline had only just begun. Of the many problems left unsolved by the 1826 bill, the method of crossing the mountains caused the most difficulty. The deliberate evasion and obfuscation of this problem during the debate resulted in a long period of further debate and indecision during the period of canal construction. Surveys during 1826 again convinced the Canal Commissioners that a portage was necessary, but, in addition to disagreement as to its form—road, rail, or a combination of the two—there was great public pressure for a continuous waterway. Consequently the Act of April 9, 1827, required the Canal Commissioners to investigate again the practicability of an unbroken canal.[5] Meanwhile, construction continued. The Act of April 9 provided for the remaining canal sections of the mainline and made the first appropriations for the many branch lines whose construction was to delay the mainline's completion.

But the portage issue remained unsettled. In their December, 1827, report the Canal Commissioners used the strongest possible terms. They felt "compelled to say, in the most explicit manner" that a continuous canal was "utterly impracticable." But the legislature would not act. In December, 1828, a new chief engineer, Moncure Robinson, was appointed and instructed to investigate the possibility of building both a railway and a road portage over the mountains, for the Canal Commissioners felt, even at this late date, that a railroad could not handle passenger traffic.[6] Robinson reported in November, 1829, in favor of a railroad portage using inclined planes, but complicated things still further by re-introducing the tunnel proposal—this time a railroad tunnel, thus eliminating the problem of a water supply.[7]

By this time the situation had become desperate. Construction had been in progress for over three years, survey after survey had been made, and there was still no agreement on the method of crossing the mountains. All the other parts of the mainline were nearing completion but could be used only for local traffic. There was widespread criticism of the Canal Commissioners. As a result, in March, 1830, the legislature provided for still another survey of the mountain area![8]

The engineers reported once again in the fall of 1830. They strongly recommended a railway portage but ruled against a railroad tunnel. On March 21, 1831, five years after work on the mainline was first authorized, the legislature authorized the building of a railroad portage.[9] Construction began in 1831 and was completed with a single track in March, 1834. During 1835 the second track was completed and the first locomotive was put in use. The entire cost of the road, including stationary engines, engine houses, water stations, machine shops, and depots, was $1,860,753.[10]

The portage railroad made a considerable impression on contemporaries; it was often referred to as one of the wonders of the modern world. It was certainly a pioneering engineering job. Extending 36.7 miles, from Hollidaysburg in the east to Johnstown in the west, it contained ten straight inclined planes, five on each side of the summit, with angles of inclination ranging from 4°9′ to 5°51′. At the head of each plane were two stationary engines of 30 to 35 horsepower each. The road's summit was 1,398.7 feet above the basin at Hollidaysburg; 1,171.6 feet above the basin at Johnstown; 2,322 feet above sea level.[11]

Another major difficulty remaining after passage of the 1826 act was the replacement of the Union Canal between Philadelphia and the Susquehanna. Mainliners were convinced that it would be a serious bottleneck when the western produce on the mainline together with the Susquehanna trade all demanded passage to Philadelphia—or went downstream to Baltimore. Since the practicability of a larger canal in the area was questionable, the Act of April 9, 1827, provided for a survey

[3] *U. S. Gazette*, January 20, 1826; *Niles' weekly register* **29**: 406–407, February 18, 1826.

[4] See *Pennsylvania archives, fourth series* **5**: 652–657.

[5] Pennsylvania Canal Commissioners, *Report . . . submitted to the Governor, February 6, 1827*, Harrisburg, 1827; Wilson, *Pennsylvania railroad, op. cit.* **1**: 99–100.

[6] Pennsylvania Canal Commissioners, *Report . . . submitted to the Governor December 11, 1828*, in Pennsylvania Senate *Journal* **2**: Appendix, 7, 1828–1829.

[7] Wilson, *Pennsylvania railroad* **1**: 100–104.

[8] Bishop, *op. cit.*, 194.

[9] Pennsylvania Canal Commissioners, *Report of the engineers relative to a portage railway*, in *Register of Pennsylvania*, 198–199, 215–217, 255–258, March and April, 1831; Bishop, *op. cit.*, 194.

[10] Wilson, W. Hasell, *Notes on the internal improvements of Pennsylvania*, 42–43, Philadelphia, 1879.

[11] *Ibid.*, 41–42.

and cost estimate for a railroad "with locomotives or stationary engines" from Philadelphia to the eastern end of the mainline canal.[12] The Canal Commissioners reported in the following December that Major John Wilson of the U. S. Topographical Engineers had advised them that the area between Philadelphia and the Susquehanna was much more appropriate for a railroad than for a canal. Consequently, in March, 1828, the legislature made the first appropriation for the Philadelphia-Columbia Railroad. It opened in March of 1834 with one track; a second track was completed in October of that year.[13]

With completion of the portage and the Philadelphia-Columbia Railroad, the form of the mainline was complete. It was 395 miles long, reached a summit of 2,322 feet above the sea, and cost $12,106,788. In contrast, the Erie Canal was 363 miles long, its summit was 650 feet above sea level, and it cost $7,143,790. There were 174 locks on the canals of the mainline for a total lockage of 1,141.5 feet, in addition to a rise and fall on the Allegheny Portage Railroad of 2,570 feet, making a total rise and fall between Pittsburgh and the Susquehanna of 3,711.5 feet. On the Erie there were 84 locks for a lockage of 689 feet. The canal prisms on both projects were the same: 28 feet wide at the bottom, 40 feet wide at the water line, 4 feet deep. Almost one-third of this project that began with a decision to adhere to the canal method consisted of railroad. Going from east to west, there were 82 miles of the Philadelphia-Columbia Railroad, 172 miles of canal, 36 miles of the portage railway, finally, 105 miles of canal to Pittsburgh.[14]

With the opening of the mainline in 1834, the confusion and delays that flowed from that hasty decision of 1826 seemed ended; Pennsylvania's interregional transportation problem seemed solved. Yet, only four years after completion of this costly and technically ingenious project, a movement was begun for its replacement. In March of 1838 a Harrisburg convention called urgently for a continuous railroad to meet the competition of the railroad projects of rival states.[15] In the following month the legislature authorized the Canal Commissioners to make surveys for a continuous railroad without inclined planes from Chambersburg over the mountains to Pittsburgh. The survey, which showed that it could be done, spurred railroad sentiment in Pennsylvania, but nothing further was done at the time.[16]

Gradually, however, a feeling of desperation developed. In 1825 it had been provoked by the completion of the Erie Canal; in 1839 it was the New York and Baltimore railroad projects.[17] In July, 1839, the legislature finally appropriated money for a survey for a continuous railroad from Harrisburg to Pittsburgh. Charles L. Slatter, the chief engineer, surveyed three alternate routes, produced a favorable preliminary report in December, 1839, and obtained an additional appropriation in 1840. His final report, submitted in January, 1842, showed it was possible to build a railroad across the state with no inclined planes and only moderate gradients. Slatter's report sparked a widespread full-railroad movement, but the depression of 1842 and the debt incurred in the building of the mainline and the many canal and railroad branches of the state works—a debt that amounted to over $33 millions in August, 1842—precluded state action. In these circumstances, there was widespread opposition to a policy which would reduce the state's revenues from the mainline.[18]

Economic recovery, together with the threat posed by the Baltimore and Ohio Railroad's advance toward Pittsburgh, revived the railroad movement, but state construction remained out of the question. However, in contrast to the situation in 1826, when there was no sign of any interest on the part of private investors in construction of the mainline, in the 1840's private construction proved feasible. The Pennsylvania Railroad Company, authorized by an act of April 13, 1846, to build a railroad from Harrisburg to Pittsburgh, received no state aid. Subscriptions by local governments, however—particularly the city of Philadelphia and the county of Allegheny with its cities of Pittsburgh and Allegheny—accounted for over half of the total capital of $12,355,000. Owing to fear of competition with the mainline, the charter imposed a tonnage tax on the new line, effective during the seasons of navigation, and refused to allow it to use the portage railroad. The tax, though modified, was not abolished until the sale of the mainline, but use of the portage railroad was granted the Pennsylvania in 1848.[19]

Perhaps nothing indicates more dramatically the conservatism of Pennsylvania's leaders than the last-minute reconstruction of the portage railroad to eliminate its inclined planes. It was undertaken in 1851, several months after the Pennsylvania Railroad had been authorized to construct a continuous railroad line

[12] *A compilation of the canal and railroad laws of Pennsylvania,* 27–28; Bishop, op. cit., 190–192; Livingood, *op. cit.,* 110; *Niles' Weekly Register* **32**: 274, June 28, 1827.

[13] Pennsylvania Canal Commissioners, *Report submitted to the Governor, December 27, 1827,* in Pennsylvania Senate *Journal* **2**: 17, 1827–1828; *A compilation of the canal and railroad laws of Pennsylvania,* 37–38; Burgess and Kennedy, *op. cit.,* 9–11, 16.

[14] Bishop, *op. cit.,* 197–199; Segal, *op. cit.,* 128; Tanner, H. S., *A description of the canals and railroads of the United States,* 52–53, 63, 97–98, New York, Tanner and Disturnell, 1840; MacGill, Caroline E., *History of transportation in the United States before 1860,* 193–194, prepared under the direction of Balthasar H. Meyer, Washington, Peter Smith, 1948; Taylor, *op. cit.,* 44; Andrews, *op. cit.,* 261.

[15] Harrisburg Railroad Convention, March 6–8, 1838, *Proceedings, passim,* including appendix, Philadelphia, 1838.

[16] Burgess and Kennedy, *op. cit.,* 25–32; Wilson, *Notes,* 52–54.

[17] See Burgess and Kennedy, *op. cit.,* 35.

[18] *Ibid.,* 25–32; Wilson, *Notes,* 52–54.

[19] Burgess and Kennedy, *op. cit.,* 33; Roberts, *op. cit.,* 79–80; Wilson, *Notes,* 43.

between Harrisburg and Pittsburgh and the president of the railroad had announced its firm intention of building an entirely new line between Johnstown and Hollidaysburg. The $2,500,000 work of reconstruction, which involved the building of a 2,000 foot-tunnel under the summit, was completed with one track in 1856, just before its sale to, and scrapping by, the Pennsylvania Railroad. "At the time the work was undertaken . . . the State had not grasped the fact that the coming of the railroad would make its whole canal system obsolete." This was in 1851![20]

The Pennsylvania Railroad opened from Harrisburg to a point of connection with the portage railroad near Hollidaysburg in October, 1850. With the opening of the railroad's western division in December, 1852, a continuous railroad from Philadelphia to Pittsburgh was achieved, but the portage railroad of the mainline was still used to cross the mountains, and the Philadelphia-Columbia Railroad was still owned and operated by the state. The railroad's mountain section, which had no inclined planes, was opened in February, 1854.[21]

The curtain rang down on the mainline in August, 1857, when it was sold to the Pennsylvania Railroad for $7.5 million. The Philadelphia-Columbia Railroad was incorporated into the Pennsylvania, and the portage railroad was immediately dismantled. The western canal division of the mainline was abandoned in 1864; part of the eastern division was continued in operation as a canal for local traffic until 1900.[22]

REGRETS AND RE-EVALUATIONS, 1826–1830

In the period following the passage of the bill for a canal mainline, as railroad technique advanced and pro-railroad opinion became dominant, above all, as the mainline began to show signs of its failure to meet expectations, mainline leaders at first tried to avoid the issue, then attempted to justify their decision, and finally revised the opinions that had led them to their canal choice. The problem first came up in August, 1826, when the Pennsylvania Society published a collection of Strickland's reports from Europe, the reports that contained the passage that came out so unqualifiedly for railroads. The problem was handled very simply: the offending passage was omitted from the Society's volume. The circumstances of the deletion were later described by John K. Kane in his obituary notice of Strickland.

Kane was a vice-president of the Society and its proofreader on the Strickland book. He was about to remit the above-mentioned passage to the printer when, "the Society's committee, and I think the Society itself, remonstrated strenuously against so perilous a committal on the part of a gentleman, whose opinions might be confounded with their own." Kane gave in, rewrote the passage, "and so saved Strickland from declaring in advance what a large part of the world knows now to be true."[23]

In its censored form the Strickland report supported the superiority of the railroad only on heavily traveled routes between commercial or manufacturing centers, where speed was important.[24] The unsigned preface to the reports, an official commentary by a member of the Society (not Strickland), stated that the Society had contributed to the conviction that Pennsylvania's interests were best served by immediate construction of a canal, "and that this should be followed by the formation of canals and railways, which will intersect and unite all the rivers and their branches in Pennsylvania." Thus a far-sighted and accurate vision of the potentialities of the railroad was reduced to a political convenience: the railroad made it possible to promise every locality something.

But the rapid development of pro-railroad sentiment in the United States, which, despite the censorship, was aided greatly by the publication of the reports,[25] soon forced Pennsylvania mainliners to revise their opinions. Baltimore's decision for a railroad in 1827 was particularly impressive. "The opinion seems to be daily gaining ground that Rail Ways are preferable to Canals, under all circumstances," remarked the Philadelphia *Democratic Press*. "If so, Maryland may have no great reason to regret that her sister States have got the start of her."[26]

The principal justification and reassessment came from the always-prolific pen of the outstanding opponent of the railroad party in 1825. Mathew Carey's retrospective articles, written in 1827 and 1830, analyzed the events of 1825–1826 and came to the conclusion that the rejection of the full railroad was the fault of the railroad party. Railroad advocacy in Pennsylvania in 1825, he contended, was a mere reflection of one of England's speculative manias. Large numbers of new companies were foisted on the gullible English public, many of them railroads in areas whose traffic could not possibly support them. To lure the public to these schemes, the unscrupulous English promoters, many of them iron masters, falsified the cost of rail-

[20] Burgess and Kennedy, *op. cit.*, 21–22; Segal, *op. cit.*, 198–199. I should add, however, that I have not investigated this period in any detail. Other factors may have been involved in the decision to reconstruct the portage.

[21] Burgess and Kennedy, *op. cit.*, 55–57, 65–66; Wilson, *Notes*, 43.

[22] Wilson, *Notes*, 56–57; Bishop, *op. cit.*, 257.

[23] Kane, John K., "William Strickland," in *Proc. Amer. Philos. Soc.* **6**: 30, 1854. See also, Haney, *op. cit.*, 25n.

[24] Strickland, *op. cit.*, 31.

[25] The *Reports* had great influence on the early railroad movement in the United States because it was one of the earliest works on the subject and showed graphically the entire process of building and equipping a railroad. The volume was subscribed to by Congress, state legislatures, the War Department, and colleges, canal companies, and individuals throughout the country. See Gilchrist, *op. cit.*, 6; and Dunbar, *op. cit.*, 902.

[26] Quoted in the Baltimore *Patriot*, February 23, 1827.

ways by comparing minimum-cost railroads with highest-cost canals. But there were some cautious persons in Pennsylvania who were sceptical of the English estimates as transmitted by American railroad advocates and who were "apprehensive that the public might be led astray by them and thus the spirit of internal improvement, which was then excited in favor of canals, be distracted between the two objects, and a triumph be afforded to those opposed to the system altogether." These cautious individuals compared the cost of construction of double-tracked railroad, as estimated by Strickland, with the cost of canal construction in Pennsylvania, and concluded that the estimates of the railroad advocates were erroneous. Railway and canal costs were found to be on approximately the same level.[27]

Carey emphasized that the canal forces "confined themselves altogether to prove the fallacy of the estimates of the railway expense by the English projectors. . . ." But when they discovered those estimates were so obviously erroneous, "they concluded that the other advantages held out, partook more or less of the same character of deception and self delusion, and in either case these projectors were unsafe guides."[28] When it was further taken into account that Tredgold, an advocate of railroads, had admitted in 1825 that the Surrey Railroad, the only available example of a general-purpose railway, had not succeeded, the doubts of the accuracy of the railroad advocates' statements were determinative. Carey concluded that the cause of the railroad had suffered extremely from the exaggerated claims of its advocates. When those claims had been exposed, "every consideration of prudence" dictated waiting for the results of the experiment in England, "before we abandoned or suspended the canal system, of the salutory effects of which we had proof before our eyes, in the Hudson and Erie and the Champlain Canals."[29]

This attempt to place the decisive weight upon the cost estimates was highly misleading. It is true that Carey did state twice during the debate that his "sole object" or "chief if not sole object" in entering the debate had been "to correct the egregious errors prevailing on the subject of comparative expense of railways in Great Britain, principally promulgated by the author of 'Facts and Observation.'"[30] But the argument that the erroneous cost estimates of the railroad advocates cast suspicion on all their other claims did not appear prominently in the debate; Carey actually used many independent arguments that covered every possible aspect of the comparison between canals and railways. Furthermore, since the railroad party had proposed, not railroad construction, but delay, Carey's retrospective justifications were not relevant to the basic issue in the debate.

However, the justifications were accompanied by a serious reassessment; Carey's opinions did change during the five years following the debate. In 1827 he referred to the Liverpool and Manchester Railroad as a "magnificent undertaking" but not yet completed. He was tremendously impressed by the Granite Railroad at Quincy, Massachusetts, and by the coal railroad at Mauch Chunk, Pennsylvania. The Quincy road, he wrote, established the fact that neither frost nor ice interfered with the use of railroads, a fact "of incalculable importance in countries where rivers and canals are locked up four or five months in the year. . . ." The fact that a single horse drew a remarkably heavy load also made a great impression upon him, although that fact had been noted many times in the reports from England during 1825 and in the writings of the Pennsylvania railroad advocates. Both the American roads that so impressed Carey were "private" railroads—each carried a single homogeneous commodity in the proprietor's cars for the use of the proprietor alone. They were of the type that had formed the principal English railroad experience up to 1825, and that had been rejected by the canal party as not relevant to a decision concerning a general-purpose railroad. Nevertheless, for Carey the two roads "removed many of the doubts of the practicability of the railroads for general purposes."[31]

In its issue of February 2, 1828, the Baltimore *American* reported the comments of the editor of the *American Farmer* on the effects upon Carey of observation of a railroad. ". . . Mr. Carey has seen the error of his *ways*. . . . He went, saw and was conquered at the Mauch Chunk Rail-Way and came back saying, seeing is believing." The motto was apt: a large part of the anti-railroad argument in 1825 seemed to be influenced by the feeling that not seeing is not believing.[32]

So impressed was Carey by these American developments that he proposed the building of what might have been the first railroad for general purposes in the United States. Such an experiment, he cautioned, should be on a route of moderate length, with moderate elevations, and in an area of considerable traffic. The twenty-eight-to-thirty-mile route between the Delaware and the Raritan seemed best for this purpose, and he hoped that the New Jersey state convention on internal improvements, to be held on September 25, 1827, would

[27] *Railroads*, 1–2, dated September 18, 1827, signed "Fulton," n.p., n.d.

[28] *Ibid.*; and *Essay on railroads*, 1–2, dated January 14, 1830, signed "Hamilton," n.p., n.d.

[29] *Railroads*, 1–2.

[30] *Internal improvement—No. 5. Railways and canals*, 4. He probably meant *Facts and arguments*. See also the letter signed "Hamilton" in *U. S. Gazette*, January 10, 1826.

[31] *Railroads*, 2–3.

[32] It is worth noting that the principal railroad advocate in Pennsylvania, the author of *Facts and arguments*, referred to "personal observations during a tour of Europe. . . ." See *Internal improvement. rail roads, canals, bridges, etc.*, 1. Presumably Carey never saw a railroad before 1827.

take this up. If such a project succeeded, then it might lead Pennsylvanians to consider a railroad from Philadelphia to Columbia, for, Carey remarked, calculation of its benefits which he would soon publish "will excite surprise and regret, that it has been so long dormant." [33]

The long dormancy of the Philadelphia-Columbia Railroad was due, at least partially, to the arguments against a full railroad mainline raised by Carey himself in 1825 and 1826. Some of those arguments had been answered by the recent railroad projects cited by Carey; many others were still unanswered by experience. Carey, therefore, had little reason to change his fundamental attitudes of 1825, and indeed, his advocacy of short-line railroads in 1827 did not represent such a change. It was the proposal of a long-range railroad that had produced those many extreme arguments of 1825 that seemed to rule out the practicability of any railroad. Those arguments did not prevent his advocacy of a portage railroad in 1825, nor of short lines in 1827. Indeed Carey and the other leaders of the Pennsylvania Society could justifiably claim that they had never opposed the new technique in principle. What they had been afraid of was delay; and what they had objected to was large-scale experimentation involving the entire future of Pennsylvania. They were against uncertainty in large issues; they hated long jumps into the unknown; they feared increasing popular resistance by advocating an innovation. They had no objection to limited experimentation leading to gradual extension of a new technique.

[33] *Railroads,* 4.

While the debate of 1825–1826 involved the relative merits of canals and railroads, the fundamental issue was whether to postpone the decision. On this question Carey, writing in 1830, was careful not to give his opinion explicitly, but he left the impression that a mistake had been made. At one period, he remarked, there was "some probability that the system of internal improvements by canals would be abandoned, or at least suspended for some time, in order to await the result of the experiments about to be tried in England." Suggested by Governor Schulze in his annual message, the proposal for delay "occasioned a schism" marked by considerable acrimony. "It is not worth while, nor would it answer to any good purpose," he concluded,

> to institute an inquiry whether it would or would not have been better to have waited two or three years to ascertain the result of the English experiment. . . . But it certainly is worth while, and prudence dictates, to reflect seriously now whether any canal not commenced should be undertaken, or a railroad substituted for it.[34]

The historian, of course, must disagree. It is very much worth while to conduct an inquiry into the reasons for mistaken decisions, particularly when those decisions involved large-scale projects and long-term horizons, and when so much of a community's economic future depended upon the result.

[34] *Essay on railroads,* 4–5. Carey states that Governor Schulze's postponement proposal was made at the session of 1826–1827. Actually it was made on December 7, 1825, to the 1825–1826 session, and was not repeated in subsequent messages. See *Pennsylvania archives* 5.

PART II. BALTIMORE

VI. THE CANAL VERSUS THE RAILROAD IN THE POTOMAC VALLEY

The Baltimore decision to build a railroad to the Ohio River was taken under circumstances closely similar to those confronting Philadelphia. Both cities were in a central position, much closer to the Ohio Valley than was New York, and both were equipped with the finest of the trans-Appalachian roads. Both, therefore, had attained a pre-eminent position in the western trade when the threat posed by the success of the partially-opened Erie Canal in 1823 set them on an urgent search for a conceivable canal route across the mountains.[1] Consequently, at the very time that Philadelphians initiated a movement for construction of a canal across Pennsylvania, Baltimoreans turned to the already-organized movement for a canal along the Potomac Valley to Pittsburgh.

But here the similarity ends. In February, 1827, after a short discussion of the potentialities of the railroad, the merchants of Baltimore decided to desert the Chesapeake and Ohio Canal project and to build instead a continuous railroad all the way to the Ohio. That decision stands in remarkable contrast to the Pennsylvania decision of February, 1826. Whereas the Philadelphians never so much as suggested the possibility of private construction of a trans-Appalachian line, the Baltimoreans decided to risk their own capital in a private venture. At almost the same time that the great majority of the Philadelphia leaders warned of the immense risks—not to themselves but to the state—of so absolutely new a thing as a long-range railroad over a mountain range, their competitors in Baltimore organized the Baltimore and Ohio Railroad Company. To find the reasons for such differences in decisions, we turn to the history of the canal and railroad projects in the Potomac Valley.

BALTIMORE AND THE CANAL PROJECTS

The first step towards a Potomac Valley canal to the west was taken on December 22, 1784, when a meeting of commissioners representing Maryland and Virginia under the chairmanship of George Washington undertook the organization of the Potomac Company. The joint act of incorporation stated the company's object to be the extension of the navigation of the Potomac River from tide water to the highest place practicable on the North Branch, and the construction of canals and locks where necessary for this purpose. Both states subscribed generously to the stock of the company, but very little was accomplished. The passing of forty years and the expenditure of $700,000 "left the *ascending* navigation of the Potomac, at all seasons as laborious and expensive as the use of the adjacent turnpike roads; while the *descending* navigation continued to be . . . totally suspended during the far greater part of every year, for want of a sufficient depth of water." [2]

The next logical step was the substitution of a full canal project for the ineffective river improvement scheme. Two early attempts to charter canal companies, in 1812 and 1816, proved abortive, partly because of the vigorous opposition of the Potomac Company, but in the latter year a general revival of interest in internal improvement led to the creation of the Virginia Board of Public Works. The Board's recommendation of a canal along the Potomac to the Ohio had no immediate result, but in 1819 the Potomac Company, plagued by financial difficulties, asked the Board for an examination to determine the best way to give future effect to the purposes of the company's charter. This led to the first survey to determine the practicability of a continuous canal through the Potomac valley. The Board's chief engineer, Thomas Moore, reported in December, 1820, that the canal to Cumberland was entirely practicable and could be built at a probable cost of $1,114,300.[3]

Moore's report became the basis of canal agitation in the Potomac area. In 1821 a joint Maryland-Virginia commission to determine what was to be done about the Potomac Company's charter recommended annulment of the charter, abandonment of river improvement, and construction of a canal at least from tidewater to Cumberland; it then proceeded to locate a canal on the basis of Moore's survey.[4]

The year that followed was an inspiring one for the canal's advocates. In May, 1822, Congress stepped into the picture with a report of the House Committee on the District of Columbia that not only affirmed the practicability of a Potomac valley canal but also recommended to the attention of the House the suggestion of the Virginia General Assembly that the improvement be extended westward to the Ohio River. This was followed by an extremely optimistic report of the Maryland-Virginia joint commission, issued in December, 1822. According to the commission's surveys and estimates, a canal along the Maryland shore of the

[1] See above, p. 6.

[2] U. S. House of Representatives, Roads and Canals Committee, *Reports . . . on the Chesapeake and Ohio Canal*, 1–3, 23rd Congress, 1st Session, House Report No. 414, April 17, 1834; Ward, George Washington, *The early development of the Chesapeake and Ohio Canal project*, 39, fn. 2, Johns Hopkins Univ. Studies in Hist. and Polit. Science, ser. XVII, nos. 9, 10, 11, Baltimore, Johns Hopkins Univ. Press, 1899.

[3] Sanderlin, Walter S., *The great national project: a history of the Chesapeake and Ohio Canal Company*, 49–50, Johns Hopkins Univ. Studies in Hist. and Polit. Science, ser. LXIV, no. 1, Baltimore, Johns Hopkins Univ. Press, 1946; Ward, *op. cit.*, 39–40.

[4] U. S. House, Roads and Canals Committee, *op. cit.*, 3, 1834; Ward, *op. cit.*, 41–43.

Potomac from Georgetown to Cumberland would cost only $1,574,954. The commission's estimate, though almost one half million dollars above Moore's, was nevertheless, a remarkably optimistic one—the canal to Cumberland ultimately cost $10 million. As was inevitable in this period, the commission depended upon a simple analogy: it took the cost per mile of the Erie Canal, then building for about five years.[5]

Canal enthusiasts, enormously encouraged by the joint commissioners' report, quickly organized a "Potomac Canal Company" and on February 11, 1823, obtained a Virginia act of incorporation which stipulated only that Maryland had to confirm it. The Potomac valley canal seemed well on its way to construction—and then came to a grinding halt. For Maryland failed to confirm: the merchants of Baltimore feared that the project would aid the Potomac cities far more than it would aid theirs. The Virginia charter lapsed.[6]

But the setback was only temporary. An internal improvement convention was held in Washington on November 6–8, 1823, with delegates representing counties in Maryland, Virginia, and Pennsylvania, but none from Baltimore (the sole Baltimorean, William Howard, was seated as an honorary member). The convention called for ultimate construction of a "Chesapeake and Ohio Canal" from Georgetown to the Ohio and an extension from there to Lake Erie, and for immediate construction of the segment from Georgetown to the Coal Banks at the eastern base of the Alleghenies. Taking the Joint Commission's cost estimate for the Georgetown to Cumberland segment as its basis and adding a "liberal amount" for the extension to the Coal Banks, the convention came up with the figure of $2,750,000 for the 212 miles to the Coal Banks, an average of $13,000 per mile. The Erie Canal, with 96 miles completed at the time, had cost an average of $11,792 per mile. The resolutions called for government financing of the entire amount: $1,000,000 from the federal government, $750,000 from Virginia, $500,000 from Maryland, and $500,000 from the District of Columbia cities. The project was considered impossible without federal aid.

The convention expected agreement on the part of all the governments concerned by the spring of 1825 at the latest and completion of construction to the Coal Banks by the summer of 1829. The huge profits to be made from this segment, according to the convention, would then be used to build the western section of the project. A Central Committee was elected to carry out the convention's plan of action.[7]

The leaders of this new drive correctly counted upon a change in Baltimore's attitude. For that city was finding it increasingly difficult to remain in sceptical isolation while New York's Erie Canal approached completion and Pennsylvania to its north and the Potomac cities to its south were proceeding with their projects. Action was possible on two fronts. To the north, a canal along the Susquehanna might join Baltimore to the Pennsylvania mainline; to the south, a branch line from the Patapsco to the Potomac might link the city to the Chesapeake and Ohio Canal. By these means Baltimore might stave off disaster but she would not necessarily gain a victory over her rivals. By the Susquehanna connection, the city would be further from the west than Philadelphia. True, the narrowness of the Union Canal, produced hopes that a good part of the mainline trade might be diverted from Philadelphia, but Pennsylvania intended to replace the Union with a wider, more direct canal. A Baltimore connection to the Potomac, on the other hand, might well give the city the victory, provided that it entered the Potomac valley far enough inland, say at the Point of Rocks. For in that case a major part of the freight from the west would certainly choose the eighty or so miles of the branch canal that would end in the large Baltimore market in preference to the fifty or sixty miles that would end in Washington. But if the branch canal went to the region around Washington instead, then the city's ability to draw the trade another fifty miles was at least doubtful.[8]

To the city's dismay, it soon became clear that construction of a canal to Point of Rocks would be extremely difficult. The bad news came on December 16, 1823, in the form of a report by a Maryland commission appointed to survey a route from Baltimore to the mouth of the Monocacy River, a few miles from Point of Rocks. The route was 81 miles long, required 899 feet of lockage and a difficult two-mile tunnel, and would cost an estimated $1,550,000. The commissioners expressed their regret that the terms of their instructions had prevented them from examining in detail the route from Baltimore to Little Falls just above Georgetown, which would have been shorter and have required much less lockage. True, it would require goods from the west to go all the way to Georgetown before electing for Baltimore, but the commissioners found reasons for a belief that the freight would continue on to the Baltimore market. One reason was the relative speed with which freight from Baltimore reached the sea. Traveling along the Potomac, it took seven days to reach Cape Henry from Washington. But it would require, according to the commissioners, only two days by canal from Washington to Baltimore plus another three days from Baltimore to Cape Henry. The other factor stressed was Baltimore's great capital

[5] U. S. House, Roads and Canals Committee, *op. cit.*, 3–4, 1834; Ward, *op. cit.*, 44–45, 68. The canal was to be thirty feet wide on the surface, twenty feet wide at the bottom, and deep enough for three feet of water.

[6] Sanderlin, *op. cit.*, 51.

[7] Ward, *op. cit.*, 48–52; U. S. House, Roads and Canals Committee, *op. cit.*, 5, 1834.

[8] See Harlow, Alvin F., *Old towpaths: the story of the American canal era*, 231–232, New York, D. Appleton, 1926; Ward, *op. cit.*, 96.

accumulation. This, together with the easier access to the sea, gave the great Baltimore market a permanent advantage that would far outweigh the disadvantages of an extra two days on the branch canal and an extra eight or nine cents on a barrel of flour. Baltimore, the commissioners concluded, had nothing to fear from the fact that her branch canal might have to lead to Georgetown; her participation in the advantages of the great canal was certain.[9]

Four days after publication of this report, the proceedings of a Baltimore meeting heralded a change in the city's attitude toward the Potomac project. The principal speaker, General Robert Goodloe Harper, appraised Baltimore's situation realistically; but his description of the prospects of the Chesapeake and Ohio Canal indicate that Baltimore too was catching a mild case of canal fever. Harper was certain that, just as the Erie Canal was transforming the trade pattern of the northern midwest, the Chesapeake and Ohio Canal would divert a large part of the trade of the southern midwest out of its Mississippi River channel. It would utterly destroy, he predicted, the up-river trade on the Mississippi, which, to Baltimore's detriment, had recently been given so great a fillip by the use of steamboats. The proceeds of western produce sent down the Mississippi would no longer be invested at New Orleans in return cargoes, but would be transmitted to Baltimore, whose goods were far cheaper, more abundant and regular, and of better quality than any obtainable at New Orleans. Harper pictured those cheap Baltimore goods floating along the great canal, then easily and quickly distributed throughout a vast area by means of the Ohio River and its branches—a great contrast to the difficulties of the up-river route from New Orleans. The greater per-mile expense of canal traffic would, therefore, easily be overcome. The canal's advantages would be enormous.

Like the Pennsylvania mainliners, Harper refused to limit the canal's influence to the southern half of the west. By means of a canal and river connection from Pittsburgh to the eastern end of Lake Erie—the one the Pennsylvanians dreamed of—the Chesapeake and Ohio would divert to Baltimore "the whole commerce" of the Lake region, for the distance from the eastern end of Lake Erie to Baltimore would be only 400 to 480 miles, while to New York by Erie Canal the distance was 722 miles. Furthermore, since the entire distance from Lake Erie to Baltimore would be traversed by a canal, except for about thirty miles on the Ohio, there would be no transshipments, in contrast to the route to New York City. "Men acquainted with commerce well know how to estimate this advantage."[10]

Although Harper's speech reveals a certain amount of canal mania, improvement propaganda in Baltimore never reached the extremes that characterized it in Pennsylvania. Harper, for example, warned against a tendency to overoptimism in regard to costs: "We ought not to deceive ourselves on this point. We ought to accustom ourselves to consider the object in its true extent: to familiarize our minds with its magnitude and its difficulties as well as its benefits." In view of the expected cost of the Erie and Champlain canals—about $10 million—it would be self-deception, he suggested, to believe that the canal to Pittsburgh could cost anything less than that sum. The extension to Lake Erie would require an additional two or three millions. But this immense expense—far beyond Maryland's resources—was no great obstacle, in Harpers' view. For the Chesapeake and Ohio would fulfill national objectives. It would aid the defense of the country and, by countering the trend to concentration of the entire trade of the west at New Orleans, it would end the separatist tendencies of east and west. Consequently, significant aid from the federal government could be expected, not only for the great canal, but also for the branch canal to Baltimore, which, Harper insisted, also involved a strong national interest.[11]

Thus, Baltimore's—and Maryland's—financial relation to the Chesapeake and Ohio Canal project was similar to Philadelphia's relation to the Pennsylvania mainline. While John Sargeant, representing Philadelphia, could regard with equanimity possible losses to Pennsylvania, Harper, representing Baltimore, could accept an expenditure of $10 million or more by the federal government and the other cities and states involved in the project. Both could afford a stronger dose of realism than could the general propaganda for the projects.[12]

But there was the problem of the branch canal. Harper agreed with the Maryland commissioners; the canal would have to go to Georgetown. If it did, it would be only fifty to fifty-five miles long, it would require only four hundred to six hundred feet of lockage, and it would cost, Harper thought, a million dollars. For this inconsiderable sum, part of which would be supplied by the state of Maryland and the federal government, Baltimore might obtain the trade of a continent. Like the Maryland commissioners, he countered the fear of the competition of the Potomac cities by stressing Baltimore's superior geographic position, a position that had given her control of the ocean trade, of the Chesapeake area, of Pennsylvania between the Susquehanna and the mountains, of Frederick and Washington counties in Maryland, and of the down-river trade on the Susquehanna. The consequent advantages of large population, great commercial capital,

[9] *Report of the commissioners appointed to examine into the practicability of a canal from Baltimore to the Potomac . . .*, 3, 19–21, n.p., n.d., 1823.

[10] Harper, [Robert Goodloe], *General Harper's speech to the citizens of Baltimore . . . on the 20th day of December, 1823*, 28–31, Baltimore, 1824.

[11] *Ibid.*, 42–44, 46.

[12] See above, p. 55.

numerous commercial connections, and a large quantity of shipping could never be overcome by the Potomac cities. Furthermore, Baltimore had far outstripped "these feeble rivals" before the development of manufacturing. Now "this great nourisher of commerce, of agriculture, and of public prosperity" was nowhere more successfully developed than in Baltimore and its neighborhood. Baltimore's supremacy was thereby completely assured.[13]

These were the positive arguments for Baltimore's support of the great canal project. But there was a far more potent negative argument. If Baltimore stood aside, Harper warned, the Chesapeake and Ohio Canal would be built to Georgetown without her; the Potomac cities, without a branch canal, would then certainly take the trade of the west. Baltimore had no choice.[14]

Harper's views were opposed by George Winchester, the other speaker at the Baltimore meeting of December 20, 1823.[15] Winchester agreed that the city's problems were serious and that something had to be done. But could it be done, he inquired, by means of a canal costing at least fourteen millions, a canal that would have to climb to a summit level of nearly three thousand feet above sea level, a canal, furthermore, that had been pronounced impracticable by Gallatin in his famous 1808 report. Even assuming that a canal were constructed, Winchester warned, it would provide no answer to Baltimore's pressing problems because it would take so long to complete. Thus, properly sceptical of a Potomac canal over the mountains, Winchester proposed instead a canal along the Susquehanna to the Conewago Falls, one that would allow Baltimore to take advantage of a canal or river-and-canal route across Pennsylvania. To this Harper answered, quite correctly, that a canal across Pennsylvania would have all the disadvantages of the Chesapeake and Ohio Canal—it would cross the Alleghenies at about the same elevation and would require about the same lockage—while the distance from Baltimore to Pittsburgh via a Pennsylvania canal would be much longer than by a Potomac waterway. The Chesapeake and Ohio, Harper concluded, was Baltimore's only hope.[16]

These were potent considerations which became more potent still when the Chesapeake and Ohio Canal convention launched its drive at the end of 1823 and when Virginia granted a charter in January, 1824. For it all fortified Harper's strongest point: the canal would be built whether Baltimore participated or not. At the same time, the canal mania sweeping the Potomac area strongly affected Maryland's western counties. Consequently, the Maryland legislature confirmed the Chesapeake and Ohio Canal charter on January 31, 1825, but with a proviso asserting the right to put through a branch canal from Baltimore to any point on the main canal within Maryland or the District of Columbia. Congress added its confirmation in March, 1825, and Pennsylvania, after two rejections, finally confirmed in February, 1826. Thus all legal obstacles to the organization of the company were finally cleared away.[17]

Meanwhile, improvement advocates obtained passage of a federal Survey Act, signed into law on April 30, 1824. President Monroe's annual message the previous December had referred favorably to the resolutions of the Chesapeake and Ohio Canal convention and had recommended a survey by the Corps of Engineers. Congress responded with a $30,000 appropriation for road and canal surveys, of which half was to be spent on surveys of the Potomac route alone during the next two years. To conduct the surveys, Monroe appointed a United States Board of Internal Improvement, consisting of General S. Bernard, chief engineer, Lieutenant-Colonel Totten, and John L. Sullivan.

The Board began work in July of 1824 and in the following February sent a favorable preliminary report to Congress. This first report declared the practicability of a canal to the head of steamboat navigation on the Ohio, and from there to Lake Erie; it eliminated a cause of much uneasiness among canal advocates by stating definitely that there was a sufficient amount of water at the summit of the Alleghenies; and, although the Board did not as yet have sufficient data to estimate the cost of the work, it declared that there was "every probability" that the expense would "not bear any comparison with the political, commercial and military advantages, which it will procure the Union."[18] This statement is reminiscent of the economic development arguments for the Pennsylvania mainline; it justified any conceivable expense. But canal enthusiasts were in no mood for fine analysis. They were delighted with the preliminary announcement and kept pressing General Bernard for his full report. His reply to the pressures might well have given the enthusiasts something to think about. Such estimates, he declared, could not be grounded upon conjecture or misleading analogies, for there were no canals "to be compared in magnitude and difficulties to be overcome, with the Chesapeake and Ohio Canal."[19] This was the first indication that the basis of all the previous cost estimates—the cost of the Erie Canal—would not be the basis of the United States engineers' report.

But the next report of the United States Board did not appear until March of 1826; in the meantime canal

[13] Harper, *op. cit.*, 33–35, 38, 45–49.

[14] *Ibid.*, 49–51.

[15] The pamphlet recording the debate contains, in addition to Harper's speech, a short resolution introduced by Winchester, and an answer by Harper in which he listed Winchester's arguments. The following opinions attributed to Winchester are taken from Harper's reply.

[16] *Ibid.*, 59–60, 65–78.

[17] U. S. House, Roads and Canals Committee, *op. cit.*, 5, 1834; Sanderlin, *op. cit.*, 54; Ward, *op. cit.*, 63.

[18] U. S. House, Roads and Canals Committee, *op. cit.*, 4–7, 1834; Ward, *op. cit.*, 71–74.

[19] Quote in Ward, *op. cit.*, 79.

agitation in Maryland reached a crescendo. A meeting held at Frederick on November 12, 1825, urged that seven delegates be appointed by each of the counties and by the cities of Annapolis and Baltimore to meet in convention in order "to unite the various local interests for a system of internal improvements" to be submitted to the legislature.[20] The convention, held on December 14 in Baltimore, sounded that note of extreme optimism combined with desperation that characterized Pennsylvania improvement agitation at the time. The optimism was of course based on the Erie Canal analogy: "There was a period when the magnitude of the undertaking appalled even the most sanguine . . . ," wrote the committee of the convention in regard to the Chesapeake and Ohio Canal, "but the delusion has been dissipated. . . . The Erie Canal . . . has rendered certain what before was problematical; it has removed the doubts of scepticism itself. . . ."[21] The note of desperation of course reflected the projects of the rival cities. The convention was warned that in view of the New York, Pennsylvania, and Potomac projects, Maryland would certainly lose the trade of the west if she did not act in support of her principal city. The state need only consider the effects of an annihilation of Baltimore: Maryland would certainly be reduced to poverty and ruin. But if Baltimore became another London, "what blessings might not be expected from it. . . ." Maryland was urged to appropriate a million dollars, half to the Chesapeake and Ohio project, half to the Baltimore branch canal. Railroads were evidently mentioned but once at the convention. Thomas Ellicott defended the constitutional right of the federal government to aid canals—and railroads, if experience proved they were preferable. "But canals have been proved in Europe and more recently in our own country." He exhorted Maryland and the federal government to aid the Potomac canal to the Ohio.[22]

On February 10, 1826, the Committee on Internal Improvements of the Maryland House of Delegates responded to the hue and cry with a report calling for support of three canals. The committee put the blame for Maryland's inadequate action in the past upon "the embarrassed state of the treasury, and the local jealousy between Baltimore and the Potomac region." But the state was no longer in debt and an annual surplus could be expected; and the committee had devised a plan to soothe sectional jealousies. The plan called for creation of a Board of Public Works to locate a canal between Baltimore and the Chesapeake and Ohio Canal; creation of a joint stock company with power to build the canal; a state subscription of one million dollars to the Chesapeake and Ohio Canal Company; and a further subscription of a half-million dollars to the Baltimore branch canal on condition that the Board of Public Works found the canal to be practicable and, if it had to pass through the District of Columbia, that Congress granted it the necessary rights in that area. Finally, the committee urged another half-million-dollar state subscription to a fund to be raised by Baltimore for a canal from that city along the Susquehanna to York Haven.[23]

Baltimore could hardly have asked for more soothing of its jealousies. In March the Assembly chartered the "Maryland Canal Company" to dig a canal from some point on the Potomac section of the Chesapeake and Ohio Canal to Baltimore and appropriated a half-million dollars to each of the three canals recommended by the Committee on Internal Improvements.[24] Surveys were begun; Baltimore's two navigable routes to the west seemed assured.

That assurance was extremely short-lived, for, in contrast to events in Pennsylvania, the realities of canal building over the mountains were unexpectedly thrust under the noses of the Potomac canal enthusiasts by an extremely authoritative group. The blow came on March 21, 1826, when General Bernard, conceding to the importunities of the canal advocates, released another preliminary report of his United States Board of Internal Improvement, this one dealing with the Georgetown-to-Cumberland section alone. The cost estimate for this section east of the Alleghenies staggered the canal's backers. It came to $8,085,000, almost triple the previous most liberal estimate. The report came after Maryland's half-million-dollar appropriation, but that appropriation was conditional: the remainder of the money necessary for the eastern section of the canal had to be raised before Maryland's appropriation could take effect. That remaining amount was now tripled, and the total cost from Georgetown to Pittsburgh, it was admitted by the United States House of Representatives' Committee on Roads and Canals in May, would not "perhaps" fall short of twenty millions. The Committee, nevertheless, continued to support the project, but Congress did not act during that session. The Chesapeake and Ohio Canal project was apparently stalled again.[25]

The full report of the United States Board of Internal Improvement was issued on October 23, 1826. It was as optimistic as ever—"A chain of mountains of secondary rank, such as the Alleghenies, cannot bar

[20] *Niles Weekly Register* **29**: 164, November 12, 1825.

[21] Phenix, Thomas, *The state convention on internal improvements; containing the resolutions . . . together with an appendix containing the views of Thomas Ellicott . . .* , 37–38 Baltimore, 1825.

[22] Phenix, *op. cit.*, 37–42, appendix, 7; *Niles' Weekly Register* **29**: 328–329, January 21, 1826.

[23] *Report . . . submitted February 10, 1826*, in Maryland House of Delegates *Journal*, 219–221, 1825–1826.

[24] Ward, *op. cit.*, 97–98; *Niles' Weekly Register* **30**: 38, March 18, 1826.

[25] Ward, *op. cit.*, 79–81; U. S. House, Roads and Canals Committee, *Report on the Chesapeake and Ohio Canal*, May 22, 1826, in *Niles' Weekly Register* **31**: 140–141, October 28, 1826.

the progress of a nation so enterprising as ours . . ."—and suggested for the first time the use of a railroad employing inclined planes and stationary engines for the mountains and other difficult sections. But the Board considered a full canal to the Ohio on enlarged dimensions, with 398 locks and a four-mile tunnel under the summit, to be entirely practicable and estimated its cost at over $22 million—a sum that, in the opinion of the canal's supporters, made the project entirely impracticable. The optimistic engineers on the Board predicted financial success: with tolls fixed at $5.85 a ton from tidewater to Pittsburgh, the canal would earn, in the first six years after its projected opening in 1838, $1,173,696 a year on the average; thereafter earnings would reach a maximum of $5,510,791 per year. Canal advocates took small comfort: $22 million was over three times the cost of the Erie Canal.[26]

The reaction in Baltimore revealed the extent to which the city had placed its hopes in the project. As a contemporary recalled it, the city's businessmen, on hearing of the report,

> . . . sat down, like the Israelites of old, by the waters of Babylon and wept. Emigration was not only "spoken of" among the merchants, but emigration, in some cases, actually took place to New York and Philadelphia. . . . if we did not actually see the grass growing in our streets, we at any rate began to fancy the space between the stones and the brick in the pavements were becoming unnaturally green. Just about this time, however, railroads were first spoken of.[27]

But it quickly became evident that the Potomac project was far from dead. In May, 1826, a report of the United States House of Representatives' Committee on Roads and Canals vigorously defended a twenty-million-dollar canal to Pittsburgh. The Committee explained that the United States Board's cost estimate was much higher than previous estimates

> not so much owing to its intrinsic difficulties, as to the magnificence and durable character of the plan [of the United States Board] . . . this work is not intended for the present age merely, but is intended to last for ages to come and give vent to the commerce between the eastern and western states when their population may be increased to tenfold. . . .

To this developmental argument, the Committee added the customary analogy to the Erie Canal. Just as canal advocates in Pennsylvania had proven, not merely that the mainline was as practicable as the Erie, but that it would be far superior, so the Committee proved that the Chesapeake and Ohio Canal would be "in every point of view, more important than that of New York," and for the same reasons: it would connect the Atlantic with the Ohio in much less than half the distance required by the New York route; it would traverse the center of the Union while the Erie canal passed through a single state and terminated at a northern frontier; it would carry Cumberland coal as well as timber and iron, all of which were denied New York's canal; and, being further to the south, its navigable season would last two months longer.[28]

Meanwhile, the Central Committee of the Chesapeake and Ohio Canal Convention hastily called a second session to meet in Washington on December 6, 1826, in order to consider the new situation created by the cost estimates of the United States Board. In accordance with the resolutions of a Baltimore public meeting, the mayor of Baltimore appointed eight delegates to the convention.[29]

Like the House Committee, the Central Committee of the Convention utilized the kind of argument that justified any expense. Its report to the convention noted that, while private subscribers should be expected to consider the prospective profit of the enterprise, cities should "blend with this condition" the value added to their "fixed and active capital"; while the states involved "may be expected to regard this prospective income as of inconsiderable moment," compared with the development of internal resources, the generation of wealth and employment, and the attraction of population; and the federal government must consider the factors of defense and internal unity.

In two respects, however, the Convention adopted a more realistic approach. Firstly, it agreed with the United States Board's suggestion that a railroad might be more advantageous than a canal in the mountains and other difficult areas and, therefore, asked for an amendment to the charter of the Chesapeake and Ohio Canal Company that would give the company a choice of two methods: either to build a full canal to Pittsburgh or to terminate the canal at or near Cumberland and construct a railroad across the Alleghenies to Pittsburgh. Secondly, it was felt to be necessary to discredit the United States Board's cost estimates and obtain a new official survey that would ascertain the "true cost" of a medium sized canal. The Committee's report to the Convention, while paying tribute to the "labor, learning and ability" of the United States Board's members, attacked every cost item in the report: wages, the prices and quantities of materials, and especially the canal dimensions recom-

[26] U. S. House, *Report . . . of the Board of Engineers for Internal Improvement . . . submitted December 26, 1826,* 77, 19th Congress, 2nd Session, House doc. no. 10. For a favorable comment on the Board's portage railroad proposal, see Maryland House of Delegates, Internal Improvement Committee, *Report . . . submitted February 12, 1828,* in Maryland House of Delegates *Journal,* 277, 1827–1828.

[27] Latrobe, *op cit.,* 4–5. Latrobe mistakenly placed these events in 1824 and 1825. The U. S. Board's reports, however, were published in 1826.

[28] U. S. House, Roads and Canals Committee, *Report on the Chesapeake and Ohio Canal, May 22, 1826,* 23, 19th Congress, 1st Session, House Report no. 228. See also the appendix to this report, 82–83 and 116–117; and *Niles' Weekly Register* **31**: 140–141, October 28, 1826.

[29] *Niles' Weekly Register* **31**: 212, December 2, 1826.

mended by the Board—the needs of the current age being the only ones of interest to the Committee.[30]

The convention bore fruit in the following March, when thirty-two members of Congress asked the President for a re-examination of the canal route and a testing of the accuracy of the Board's estimate. President Adams promptly complied with the appointment of James Geddes and Nathan S. Roberts, two engineers with experience on the Erie Canal and the Pennsylvania State Works. The new survey was begun at once.[31]

Additional support came from Maryland. The January, 1827, report of the Assembly's Board of Public Works resorted to an argument common in Pennsylvania. The greater the canal's cost, the Board asserted, the greater Maryland's gain: ". . . if the canal should cost eight millions instead of three, by so much, to the citizens of Maryland, through whose territory it is exclusively to be made, will the benefit be enhanced." The argument had more justification in Maryland than in Pennsylvania: it was believed that most of the money for the Chesapeake and Ohio Canal would come from outside the state. The Board attacked the proviso in Maryland's subscription to the Chesapeake and Ohio Canal that prohibited it from taking effect until the subscription should complete the amount necessary to build the eastern section of the canal. Pointing to the discrepancy between the United States Board of Internal Improvement's eight-million-dollar estimate and the amount—one-third as much—estimated by the December meeting of the Chesapeake and Ohio Canal Convention, the Board contended that this much uncertainty made the state's requirement unrealistic: no one knew what the required amount would be. The Board believed that a ten-thousand-share subscription by Congress, supplementing another ten thousand shares subscribed by the states and cities involved, would be a sufficient guarantee of completion of the project, since "if the States and Cities remain inactive, and individuals refuse to participate, the Government will execute the work which it shall have undertaken."

In regard to Baltimore's branch canal, the Board had reported in the previous November that its surveys for a canal from the Potomac at Little Falls to the Patapsco at Baltimore had indicated that the project was practicable. The highest point of land along the route was two hundred feet above sea level. If, by deep cutting, the summit level of the canal were reduced to one hundred and forty feet, there would probably be a sufficient amount of water.[32] The Board did not yet have the engineer's report, but it was able to strengthen its November statement. The Assembly was assured that the engineer's report would remove all doubt of the practicability of a canal that would pass through Georgetown and Washington; at the same time, a canal to the area around Point of Rocks was definitely ruled out. Since doubt of the practicability of any branch canal, the Board averred, "has been the chief source of the division, which has hitherto perplexed the friends of improvement in Maryland, its removal will we trust produce that harmony of design and effort, which must lead to the happiest results." The Committee on Internal Improvement of the Maryland House of Delegates, reporting in the following month, adopted the same tone: ". . . though the survey is not completed, yet enough has been achieved to allay all doubts of the practicability of such a lateral canal." There is no mention of railways in either report.[33]

Thus did the Potomac canal project regain its momentum after the rude shock of the March, 1826, report of the United States Board. Canal mania could be moderated perhaps, but it could never be destroyed by a mere cost estimate. There was good reason, therefore, for the Baltimoreans to place their hopes once again in the canal project. If before the report they had believed in the advantages to Baltimore of the canal—as they obviously did, judging from their reaction to the United States Board's report—then they had as good reason to believe in it again, once the affected states and the federal government had shown their willingness to go along. For, as noted, Baltimore had little reason to be deterred by large expenses; it would not foot the bill.[34]

ORIGINS OF THE BALTIMORE AND OHIO RAILROAD

It was precisely in this period, however, that serious interest in the railroad first appeared in Baltimore. The impetus was provided by a Quaker merchant, Evan Thomas, who returned from England in the fall of 1826 deeply impressed with the operation of the Stockton and Darlington Railroad. Although he had

[30] Chesapeake and Ohio Canal Convention, *Proceedings . . . on the sixth day of November, 1823 and re-assembled . . . on the sixth day of December, 1826,* 34, Washington, 1827. The Central Committee's Report to the Convention is cited in U. S. House, Roads and Canals Committee, *op. cit.,* 10–13, 1834. Sanderlin, *op. cit.,* 55 contends that the criticisms of the U. S. Board's estimates were valid in part.

[31] Ward, *op. cit.,* 82; Sanderlin, *op. cit.,* 56; U. S. House, Roads and Canals Committee, *op. cit.,* 8, 10–13, 1834.

[32] *Niles' Weekly Register* **31**: 169, November 11, 1826.

[33] "Report of the Board of Public Works to the General Assembly of Maryland, January 1827," in Baltimore *American,* February 9, 1827; Maryland House of Delegates, Internal Improvement Committee, *Report . . . submitted February 15, 1827,* 316, in Maryland House of Delegates *Journal,* 1826–1827.

[34] *Cf.,* however, Milton Reizenstein, *The economic history of the Baltimore and Ohio Railroad, 1827–1853,* 11, Johns Hopkins Univ. Studies, 15 ser. **7** and **8**, Baltimore, Johns Hopkins Univ. Press, 1897, where he states that the twenty-two-million-dollar cost estimate in the U. S. Board's report "in the light of subsequent events, may be regarded as one of the direct causes leading to the construction of the Baltimore and Ohio Railroad. It was believed that the burden of payment would fall on the state of Maryland and the city of Baltimore rather than upon the national government. In consequence, when the enormous cost of the project became known, the enthusiasm in Baltimore for the construction of such a canal was considerably abated. . . ."

"no very distinct views on the subject," he gave a vivid description of the railroad to his fellow guests at a dinner given by John Eager Howard. Evan's account greatly impressed the gathering, and especially his brother, Philip E. Thomas, who then became the leader of a discussion group that gathered and evaluated all the available information on the new technique.[35]

Evidently, this beginning of railroad discussion in Baltimore was not directly determined by the canal events of that year. But the shock of the United States Board's reports might well have prepared the soil for this strange new means of transportation. Moreover, at this very time, Baltimoreans were reading of a closely analogous situation to the north: as a result of surveys that had placed in doubt the practicability of a canal from Boston to Albany, meetings of Boston citizens and a Massachusetts legislative committee were seriously considering the railroad alternative.[36]

The first formal meeting to consider the possibility of a railroad from Baltimore to the Ohio was called by George Brown for February 12, 1827. Twenty-five of the leading citizens of Baltimore met at his house "to take into consideration the best means of restoring to the City of Baltimore, that portion of the Western Trade, which has lately been diverted from it by the introduction of Steam navigation and by other causes. . . ." William Patterson was appointed chairman and David Winchester secretary. The meeting was short and decisive, indicating that much prior private discussion had taken place:

> Various documents and statements, illustrating the efficiency of Rail Roads, for the conveying of articles of heavy carriage, at a small expense, were produced and examined; and the superior advantage of this mode of transportation over Turnpike roads or Canals, in many situations being, according to those statements, satisfactorily shown, it was on motion, Resolved that the said documents be referred to a Committee whose duty it shall be to examine the same, together with such other facts and experiments they may be able to collect. . . .

Chosen for the committee were Philip E. Thomas, Benjamin C. Howard, George Brown, Talbot Jones, Joseph W. Patterson, Evan Thomas, and John V. L. McMahon. Everyone present contributed ten dollars to a fund for the committee and the historic meeting adjourned.

A detailed report was delivered to the re-assembled group one week later, on February 19—again indicating a considerable amount of work by individuals prior to these meetings. The committee warned that Baltimore was in serious jeopardy; that, while the project of a canal along the Susquehanna valley to connect with the projected Pennsylvania state canal would be useful, for it would secure to Baltimore the ascending and descending Susquehanna river trade, this trade was but a minor consideration when compared to "the immense commerce which lies within our grasp to the West. . . ." For the western trade, Baltimore had great advantages. The committee pointed out that the city was two hundred miles nearer than New York and one hundred miles nearer than Philadelphia to the navigable waters of the west, while the Potomac valley was the "most practicable" route through the mountains.[37] The analysis of the relative advantages of canals and railroads that followed relied heavily upon quotations from Strickland's report to the Pennsylvania Society, as well as the standard works by Wood and Gray.[38]

In an appendix, the Committee compared the combined Chesapeake and Ohio and Baltimore branch canals with the proposed railroad. The former would be 390 miles long, the latter 250 miles (to Wheeling). Regarding costs, the committee generously halved the United States Board of Internal Improvement's estimate for the canal from Washington to Pittsburgh, making it only eleven millions, to which it added one million for the branch to Baltimore. In contrast, "the highest estimated cost of Rail road from Baltimore to the Ohio River, calculating the same to cost $20,000 per mile (and this is believed to be a very high estimate) would be $5,000,000." As for the time required to convey freight, the United States Board had estimated 188 hours for loaded boats from Washington to Pittsburgh. To this figure the committee added a proportional amount for the distance from Baltimore to Washington, making 214½ hours. But a loaded railroad car traveling at a conservatively estimated average of four miles per hour would reach the Ohio in 62½ hours.[39]

The Committee presented its conclusions forcefully, with no indication of doubt or hesitation:

> . . . these roads are far better adapted to our situation and circumstances than a Canal across the Mountains would be: they therefore recommend that measures be taken to construct a double Rail Road between the City of Baltimore and some suitable point on the Ohio River. . . .[40]

The meeting unanimously approved the report and resolved upon immediate application to the Maryland legislature for a charter incorporating a joint-stock company with capital stock of $5 million, the company to be organized upon subscription of $1 million. The obtaining of the charter was left in the hands of a committee of twenty-five; fifteen hundred copies of the

[35] Latrobe, John H. B., *The Baltimore and Ohio Railroad: personal recollections,* 5, *Baltimore,* 1868; Frank R. Kent, *The story of Alexander Brown and Sons,* 118, Baltimore, Alexander Brown and Sons, 1925.

[36] See Baltimore *American,* January 17, January 20, and Feburary 6, 1827; Baltimore *Patriot,* January 20, 1827; Baltimore *Gazette,* February 2, 1827.

[37] *Proceedings of the sundry citizens of Baltimore,* 3–6, Baltimore, 1827; Edward Hungerford, *The story of the Baltimore and Ohio Railroad* 1: 19, New York, G. P. Putnam's Sons, 1928.

[38] *Proceedings of the sundry citizens . . . ,* 8–17.

[39] *Ibid.,* 33–37.

[40] *Ibid.,* 7–8.

proceedings of the two meetings of the "Sundry Citizens" were ordered printed.[41] Thus was launched the world's first long-range railroad project. The spanning of the continents had begun.

The first Baltimore newspaper comment on the railroad appeared in the form of an unsigned letter on February 19, the same day as the second meeting. It began with a reference to the prodigious projects planned in Pennsylvania. Baltimore, the letter warned, had been "lulled into *false security* and supineness." If she did not rise from her lethargy, "it will be the sleep of death and destruction." How long, the author cried, would Baltimore dream about the Chesapeake and Ohio Canal—a canal with more than four hundred locks and a long tunnel, one that would be frozen half the year and dried up the other half. The project was totally impracticable: *"Depend upon it you will never see a canal between this city and the Ohio River!"* Baltimore had to find a more efficient method, and that would be a railroad, "with locomotives and stationary engines, inclined planes, etc." All reports from England, the writer asserted, established beyond dispute that railroads, whether in mountainous or level areas, were cheaper than canals, seldom got out of repair, and could carry freight and passengers day and night, summer and winter, at a rapid pace. The recent report of the United States Engineers estimated the cost of the Chesapeake and Ohio at $22 million, and the distance at 341 miles. To this would have to be added the fifty miles from Georgetown to Baltimore, for, the writer pointed out, there was no other practical route for the branch canal. The Chesapeake and Ohio, therefore, "would be of no use to *us*," even if completed.

> Having of course no other alternative left, let us apply all our energies without loss of time . . . [to] *the construction of a double railroad on the most improved plan*, which will bring the great bend of the Ohio almost to our very doors. . . .[42]

The editorial reaction in the Baltimore press was entirely favorable; and it took the committee of twenty-five appointed by the February 19 meeting of the Sundry Citizens only nine days to procure a Maryland act chartering the Baltimore and Ohio Railroad Company. The charter provided for a capital stock of $3 million, to consist of 30,000 one-hundred-dollar shares. Ten thousand shares were to be reserved for one year for subscription by the state of Maryland; five thousand more were reserved for Baltimore. The remaining fifteen thousand shares were available to individuals and corporations upon initial payment of one dollar per share; when ten thousand of these were taken, the company could organize. In case Maryland or Baltimore failed to subscribe, the president and directors could make any disposition they saw fit, provided the shares sold at par value. Construction had to begin within two years of passage of the act; the road had to be completed in Maryland within ten years of the start of construction. "Tolls" for goods and passengers were fixed by the state. Most important, the road was granted exemption from all state taxes.[43]

The stock subscription was a great success, and the company was organized on April 23, 1827, with Philip E. Thomas as president. Application was made for United States engineers, who commenced their survey with remarkable speed. Their report, issued on April 5, 1828, assumed that the line would probably be worked by horses, possibly by locomotives, and would be built for both; it also assumed that ordinarily the gradient must not exceed thirty feet per mile and made this possible by allowing a great deal of lateral curvature in the line. Steeper grades would be handled by inclined planes and stationary engines. The railroad's own engineering department was organized in the same month, and on May 5 it formally recommended the route along the valley of the Potomac. The first annual meeting in May, 1828, formally selected the route: along the Patapsco River to the Point of Rocks, then along the north shore of the Potomac to Harper's Ferry. The decision to use the Potomac valley led to years of delaying litigation with the Chesapeake and Ohio Canal Company, but was unavoidable.[44]

Despite the progress of the railroad project, the surveys for the Baltimore branch canal had continued to completion. The report presented by William Howard and dated June 25, 1827, reaffirmed the necessity of going through the city of Washington and called for deep cutting or tunnels at "formidable expense" in order to pass the three intervening ridges on a single summit level.[45] The Committee on Internal Improvement of the Maryland House of Delegates advocated all the projects—the Chesapeake and Ohio Canal, the Baltimore branch canal, and the Baltimore and Ohio Railroad—but the Governor of Maryland had already placed the branch canal in the category of projects of last resort in his annual message of January 2: '. . . it [the report] contains information very desirable to be possessed by both the General and State Governments, which can be resorted to for practical purposes either at the present or any future time." Nothing further was done.[46]

Meanwhile, the backers of the Chesapeake and Ohio

[41] *Ibid.*, 31–32.

[42] Baltimore *American* and Baltimore *Gazette*, February 19, 1827.

[43] Hungerford, *op. cit.* 1: 27–29; Baltimore *American*, February 28, 1827.

[44] Cohen, Mendes, Address at the Annual Convention . . . , in *Trans. Amer. Soc. Civil Engineers* 26: 538–540, June, 1892; Ward, *op. cit.*, 99. See also, Maryland House of Delegates, Internal Improvement Committee, *op. cit.*, 279, 1828, "Report of Col. Long . . ."

[45] U. S. Army. Engineers Department. *Report on the survey of a canal from the Potomac to Baltimore . . . submitted January 11, 1828*, 8–9.

[46] Baltimore *American*, January 7, 1828. See also the issue of February 2, 1828.

project proceeded with their program of obtaining a new official cost estimate for their project. As noted above, in March of 1827 President Adams had appointed James Geddes and Nathan S. Roberts to conduct a new survey of the entire route from Georgetown to Cumberland and to revise the cost estimate of the United States Board on the basis of current wages and prices of materials. Geddes and Roberts reported on March 15, 1828: a canal of approximately the dimensions assumed by the United States Board could be constructed as far as Cumberland for $4,479,346.93, thus reducing the cost of the eastern section "below the most ardent hopes of the friends of that enterprise." In May, Congress subscribed one million dollars, which fulfilled the condition for Maryland's half-million-dollar contribution. The Chesapeake and Ohio Canal Company was formally organized in June with a capital of $3,608,400: $1 million from the federal government, $1 million from the city of Washington, $500,000 from the state of Maryland, $500,000 from the towns of Alexandria and Georgetown, $2,000 from the corporation of Shepherdstown in Virginia, and $606,400 from individuals.[47]

By this time the Potomac cities were wild with canal enthusiasm. At the same time Baltimore was gripped with railroad mania. July 4, 1828, marked the formal start of construction of both projects, and both headed for the narrow Potomac Valley, where constructive enthusiasm was for long swamped by destructive litigation.

VII. THE BALTIMORE AND PENNSYLVANIA DECISIONS COMPARED

With construction of the Baltimore and Ohio Railroad well under way, we return to the questions raised at the beginning of the last chapter: what can account for the differences between the Pennsylvania and Baltimore decisions when the circumstances were so similar? How can we explain the fact that in February, 1827, Baltimoreans were willing to accept the railroad as an alternative to the canal, while in February, 1826, the Pennsylvanians would accept it only as an auxiliary? There seem to be four possible explanations:

(1) Baltimoreans may have regarded the railroad more favorably because of an advance of railroad technology and experience between the two dates sufficient to eliminate the more important objections to the railroad that were raised in Pennsylvania.

(2) It is possible that Baltimoreans rejected the canal because the United States Board of Internal Improvement had confronted them with a relatively realistic estimate of the cost of the Chesapeake and Ohio canal project. The corresponding factor in the Pennsylvania case was the scepticism expressed by Charles Trcziyulney in his minority report as Canal Commissioner in February, 1825. But Trcziyulney did not have anything like the prestige of the United States Board, nor could his investigation of the situation have been as thorough.

(3) Geographic factors may explain the difference in the decisions. In the introduction to this work, I contended that the problems of crossing the mountain range were essentially similar for the three rivals of New York. But, as between Philadelphia and Baltimore, there were differences in the characteristics of the non-mountain areas and in the geographic relation of each city to its main east-west line.

(4) The three explanations thus far mentioned cover, I believe, every important difference in situation and available information. If they cannot fully explain the differences in the decisions, then we must rely upon a residual, subjective explanation as well: the leading merchants of Baltimore may have, in all things, regarded uncertainty less fearfully and imitation more sceptically than did the leaders of the improvement movement in Pennsylvania.

In the following pages I shall attempt to evaluate the importance of each of these explanations.

DIFFERENCES IN RAILROAD TECHNOLOGY AND EXPERIENCE

Fortunately, the published report of the committee to the February 19 meeting of the Sundry Citizens provides us with a clear account of the results of the group's investigations; it contains all the technical knowledge upon which the Baltimore railroad decision was based. A good part of the report contains extracts from authorities on the railroad. All of these, with one exception, had been well known to the Pennsylvania Society in the previous year. Ironically, the reports of the Pennsylvania Society's investigator, William Strickland, were extensively quoted; the committee's other authorities were Tredgold, Wood, Gray, and Jessop, but only extracts from Jessop's work were available to the committee.[1] The one cited work that had not been available the year before was the recent report of a Massachusetts legislative committee, which recommended a railroad from Boston to the Hudson River and which cited in the railroad's favor the recently constructed "Granite Railroad" at Quincy, Massachusetts (undoubtedly the Phelps Committee Report). Other references to facts that had been unavailable to the Pennsylvanians consisted of a footnote, added by the committee to its quotations from the Massachusetts report, which cited the U. S. Engineer's suggestion of a portage railroad in the mountain section for

[47] U. S. House, Roads and Canals Committee, *op. cit.*, 8–10, 13–14, 1834; Ward, *op. cit.*, 82–83; Sanderlin, *op. cit.* 56–57.

[1] *Proceedings of the sundry citizens . . .*, 8–17; *The early correspondence of Alex. Brown and Sons with regard to the building of the Baltimore and Ohio Railroad*, 4, Baltimore, Alex. Brown and Sons and the Baltimore and Ohio Railroad, 1927.

the Chesapeake and Ohio Canal; and a short extract from the London *John Bull* on the advantages of locomotives.[2]

Three events, then, comprise the increase of technical knowledge and experience between February, 1826, and February, 1827: the record of the Stockton and Darlington Railroad during this period, the recommendation of a railroad from Boston to Albany by a Massachusetts legislative committee, and the construction and operation of the Quincy Railway. But the Stockton and Darlington had opened in September, 1825, almost half a year before the Pennsylvania decision, and Strickland had described its plans and construction in his reports to the Pennsylvania Society. And while the Massachusetts report may have been important as an indication of a trend to the railroad by cities in similar circumstances—as the Sundry Citizens put it, "the district of Country between the places [Boston and Albany] being in many respects similar to that between us and the Ohio river . . ."—it was dated January 19, 1827, and could not have reached Baltimore much before the February meetings of the Sundry Citizens. Neither of these events could explain the differences between the decisions.

The Quincy Railroad was more important. Built to carry granite for the Bunker Hill Monument from the quarries at Quincy to the Neponset River, it received its charter in March, 1826, and opened in October of the same year. The railway was of the specialized type that had properly been rejected by the Pennsylvanians as a reliable guide to the problems of a general-purpose railroad: it was "private," hauling a single, homogeneous commodity for one company; it was only three miles long; it hauled freight only on a downgrade along the single incline from quarry to river; and it used only horsepower. It was far more primitive than the Stockton and Darlington. But it did prove that the severe American frosts would not break up the track, and it must have had an important demonstration effect: Baltimoreans knew of and could observe an actual railroad in operation in the United States.[3]

Thus, aside from the problem of the effect of frost upon rails, there was neither an advance in technology nor an increase in experience in the year following the Pennsylvania decision that would have helped to answer the many objections to the general-purpose railroad. The Pennsylvania requirement of a full testing was to be supplied only in 1829 by the Rainhill locomotive trials and in 1830 by the operation of the first true general-purpose railroad, the Liverpool and Manchester.

THE UNITED STATES BOARD REPORTS

The problem here is to determine whether the Board's report produced a significant change in Baltimore's evaluation of the Chesapeake and Ohio canal project. As noted above, the extremely depressed reaction in Baltimore to the Board's reports indicates the extent to which the city had placed its hopes in the project.[4] It is important to be clear as to the reason for the discouragement. Was it because those higher costs would be larger than the conceivable benefits from the canal? This is highly unlikely: Baltimore would pay but a small share of those costs. Was it because the canal was technically unfeasible? But the United States Board had emphasized its practicability. It was only the cost problem that was raised by the Board's report, and Baltimoreans were shocked by the realization that the affected states and the federal government might not contribute such large funds. With great reluctance and a far more realistic attitude than was common during the canal mania, they had granted their support to the project because it would be built in any case, and they had placed their hopes in it because the projects of their competitors forced them to find immediately a route to the west. With the publication of the United States Board's cost estimate, it looked, for the moment, as if Baltimore's last desperate hope was gone.

However, the events that followed the publication of the Board's reports indicated that the affected states and the federal government would continue to support the project. There is much evidence indicating that at the time of their railroad decision Baltimoreans knew that the Chesapeake and Ohio project would proceed and considered it to be a real, if inferior, alternative to their railroad. Firstly, if doubt of the canal project's future had played an important role, the Sundry Citizens would have projected their railroad only to the Point of Rocks, extending it further only when it became clear that the canal project would fail. Secondly, on the eve of the railroad decision three important Baltimore dailies—the *American,* the *Gazette,* and the *Patriot*—as well as *Niles' Weekly Register* advocated support of the Chesapeake and Ohio. Thirdly, the comments of the Baltimore *American* just after the railroad decision indicated clearly that, in the Baltimore view, the United States Board's report had not ruled out the canal alternative and that the issue between

[2] *Proceedings of the sundry citizens . . .*, 17–21.

[3] The strong effect upon Mathew Carey of riding on the Mauch Chunk, a railroad of the same type as the Quincy, was described above. The Mauch Chunk, whose construction was begun in January, 1827, and completed in May, carried coal for nine miles on a single downward incline from the coal mines at Mauch Chunk, Pennsylvania, to the Lehigh River. Gravity carried the cars, the coal, and the mules from the mine to the river, then the mules hauled back the empty cars. For a description of this railroad and the Quincy, see John W. Starr, Jr., *One hundred years of American railroading,* 27–37, New York, Dodd, Mead and Co., 1928. A committee appointed by the Baltimore and Ohio Railroad Company examined both of these railroads. For its report, dated June 12, 1827, see *Niles' Weekly Register* 32: 284, June 23, 1827.

[4] See above, p. 68.

canal and railroad was as real in Baltimore in February, 1827, as it had been in Pennsylvania in February, 1826. The editorial listed the disadvantages of a canal as follows: "the scarcity and annual diminution of water, the immensity of the lockage, and the delay arising from it, the large portion of the year in which the canal would be frozen, and, finally, its insalubriousness during the autumn in this latitude." There was no mention of cost. The editor remarked that the delay of the canal project had saved the city from "embarking in a scheme of secondary utility" and he commended those "who originally drew the attention of our citizens, and at a time when the theme was not popular here, to the value of a canal connecting to the west." [5]

Clearly the canal was considered a real alternative to the railroad, but one of "secondary utility." What then was the effect of the United States Board's report? Presumably, it should have shattered the prevalent canal fever in the Potomac area; but canal mania there reached new heights in 1827 and 1828. Presumably, it should have made the Baltimoreans more realistic about the canal; but their attitude had always been realistic: in December, 1823, even a canal enthusiast such as General Harper was warning against self-deception as to costs and difficulties. We must conclude that the Board's report had only a temporary shock effect. Since it came just before the period when, for independent reasons, a railroad discussion was going on in Baltimore, it may well have given an impetus to discussion of the railroad idea. But it could not have determined to any important degree the difference between the Pennsylvania and Baltimore decisions.

THE GEOGRAPHIC FACTOR

The effects of differences in the characteristics of the mountain barrier separating Boston, Philadelphia, and Baltimore from the west have been taken up in Chapter I. Here we are concerned with two other geographical differences: the characteristics of the Potomac valley as compared to the area in Pennsylvania between the Susquehanna River and the Portage Railway; and the geographic relation of Philadelphia and Baltimore and to their respective main canal lines to the west.

From the point of view of canal-building, the outstanding characteristic of the Potomac valley is its narrowness; for long stretches, mountain cliffs on both sides confine the river to a narrow gorge. As a result, the canal along the Potomac had to lie for miles on the very margin of the river, sometimes partly in the river channel itself, exposed to the full force of the frequent violent freshets in the valley. Such a canal could not be made permanent except at enormous cost. Hence the canal as constructed from Georgetown to Cumberland—it never did cross the mountains—turned out to be extremely expensive, not only because of high initial cost—almost ten million dollars for the 184½ miles—but also because of constant breaches which produced very high maintenance costs.[6] The Pennsylvanians did not have this particular problem.

These characteristics of the canal as constructed reveal the lack of realism of the cost estimates, even that of the United States Board of Internal Improvement. But these problems were not raised at the time. George Winchester, for example, did not mention the canal maintenance problem when opposing the Chesapeake and Ohio Canal at the December, 1823, Baltimore meeting, nor was it raised by the Sundry Citizens in their criticism of the canal alternative. The difficulty was not foreseen partly because of an accident of climate: only one freshet, in 1810, gave serious trouble to the Potomac Canal Company's works; even then, the works held up well.[7] Hence the problem was overlooked by all; it could not have been the cause of the greater scepticism of the Baltimoreans.

Another geographic difference between Philadelphia and Baltimore resided in the relation of each city toward its respective main canal line. The difference appears large on the map: the Philadelphia-Columbia Railroad is simply an extension in the same direction of the east-west line from Pittsburgh, but any extension to Baltimore from the main line of the Chesapeake and Ohio Canal would have to branch off in a northeast direction while the main line continued to Georgetown. But this difference is superficial; the competitive positions of the two cities were entirely analogous. Just as one of the most difficult problems confronting Philadelphia was the construction of an adequate connection to the terminus of the proposed Pennsylvania canal at the Susquehanna, one of the most difficult of Baltimore's problems was the construction of an adequate connection to the Potomac valley. Just as the Philadelphians feared that without such a connection the hoped-for flood of western goods on the Pennsylvania canal might pour down the Susquehanna to Baltimore, the Baltimoreans feared that without such a connection the Potomac valley canal would benefit primarily their competitors in the Potomac cities of Georgetown, Alexandria, and Washington.

These similar circumstances produced almost identical alternatives. At first, both cities placed their hopes in a canal connection to their respective mainlines: the Philadelphians expected that the Union Canal between their city and the Susquehanna would soon be replaced by a wider, more direct canal; the Baltimoreans planned a "Maryland Canal" between Baltimore and the Potomac. But both cities were soon forced to change their plans. Only a railroad, the Philadelphians discovered, could provide an adequate transportation line in that difficult area; only a railroad, the Baltimoreans found, could connect their city to a point on the Po-

[5] February 26, 1827.

[6] Sanderlin, *op. cit.*, 161, 283–286; Ward, *op. cit.* 44–45.

[7] Sanderlin, *op. cit.*, 46.

tomac sufficiently inland to eliminate the dangers of competition from the Potomac cities. Furthermore, since both cities had to cross the Appalachians, both were confronted in the period before their decisions with the strong possibility that a second break in their canal lines—a railroad portage over the mountain sectors—would be required.

Thus, the railroad offered to Baltimore, as it did to Philadelphia, a method of crossing the mountains while cleaving as closely as possible to the tried and tested method of canalling. The Baltimoreans could have projected their railroad to the Point of Rocks, the point on the Potomac to which the Baltimore and Ohio was ultimately constructed. If the railroad had stopped there, and the city had put its influence and resources behind the Chesapeake and Ohio Canal, Baltimore would have obtained a mongrel line to the west: a railroad to the Potomac valley, a canal to Cumberland, and a railroad across the Alleghenies (as had been suggested by the United States Board), if not another canal to the west of the mountains as on the Pennsylvania mainline.[8] Clearly, in regard to the transportation problem, the geographic situations of the two cities were almost identical.

THE LEADERSHIP FACTOR

Since differences in situation and available information are insufficient to explain the differences between the Pennsylvania and Baltimore decisions, we turn to a subjective factor, to the differences in the attributes of the respective leaderships. The merchants of Philadelphia were unwilling to risk their own capital. Dependent on state appropriations, they could only urge, cajole, and compromise; and when confronted with the full railroad proposal, they felt that they had to reject it partly because it would increase popular prejudice against the improvement, hence make it more difficult to obtain the appropriation. The merchants of Baltimore, in contrast, led by example. Their decision to build the railroad was made independently of the question of state and city subsidy (except for tax exemption). Undoubtedly they hoped for, and expected, subsidies, but subsidies were not made a prerequisite for the decisions. As a result, they could proceed swiftly and decisively. Far from spending a year of effort on intense improvement propaganda in the fashion of their Pennsylvania contemporaries, they held two rather small formal meetings, then simply announced that they were going to build a railroad to the Ohio. There was no public propaganda effort before the decisions—the very first word of the railroad proposal appeared in the newspapers on February 19, the day of the decision by the second meeting of the Sundry Citizens. And the only formal propaganda effort after the decision that I know of consisted of the printing of fifteen hundred copies of the proceedings of the two meetings.

And yet, the Sundry Citizens were remarkably successful in winning popular support. As noted above, before the publication of the railroad proposal three Baltimore dailies and *Niles' Weekly Register* had campaigned for the Chesapeake and Ohio and for Baltimore's branch canal. With publication of the Sundry Citizen's project, they all campaigned for the railroad. And, according to *Niles' Weekly Register*, ". . . no one seems to doubt the immediate making of this road."[9] There is no evidence of serious opposition in Baltimore to what was for those days a revolutionary idea. As a result, the project could be carried through with a speed that contrasts remarkably with the pace of such things in Pennsylvania. As noted above, once the decision for the railroad was made at the second meeting of the Sundry Citizens, it took exactly nine days to obtain a charter from the state legislature.

The extent of popular support for the project is evident from the great success of the stock subscription. The books were opened on March 20, and within eleven days the stock was heavily oversubscribed. In Baltimore alone, 36, 788 shares were sold to 20,000 people (excluding the 5,000 shares taken by the city of Baltimore). Individuals in Frederick and Hagerstown took another estimated 2,000 shares. The company encouraged widespread ownership as an aid in obtaining public support.[10] Here is an observer's recollection of the public mood at the time of the sale of stock:

> Then came a scene which almost beggars description. By this time public excitement had gone far beyond fever heat and reached the boiling point. Everybody wanted stock. . . . Before a survey had been made—before common sense had been consulted, even, the possession of stock in any quantity was regarded as a provision for old age and great was the scramble to obtain it.[11]

Here is evidence, not of calculated support for the railroad, but of railroad mania. Visionary symptoms appeared even in the sober pages of *Niles' Weekly Register:* "Thus will scientific power conquer space, and even the Alleghenies sink, as it were, beneath the pressure of unconquered steam, nay, the laws of gravitation give way before the march of mind!" The article ended with a prediction of Oliver Evans—that the distance between Philadelphia and Boston might soon be

[8] In October, 1827, William Hollins, who opposed state aid to the Baltimore and Ohio because he believed long-range railroads were too risky, proposed a branch railroad to Washington in case the proposed branch canal turned out to be impracticable. He was sceptical of the railroad's efficiency in the more hilly country between Baltimore and the Point of Rocks. See [William Hollins] *Railroads in the United States of America . . .*, 34, Baltimore, 1827.

[9] See the Baltimore *Gazette*, February 23, 1827; Baltimore *American*, February 24 and 26, 1827; Baltimore *Patriot*, February 26, 1827; *Niles' Weekly Register* 32: 34, March 17, 1827.

[10] *Niles' Weekly Register* 32: 100, April 7, 1827; Kent, *op. cit.*, 116; Maryland, House of Delegates, Internal Improvement Committee, *op. cit.*, 272, 1828.

[11] Latrobe, *op. cit.*, 6.

covered in a single day. This kind of prediction, when made in Pennsylvania, had proven the visionary character of the railroad advocates.[12]

The enthusiasm evidently reached out to the western cities as well. An editorial in the Cincinnati, Ohio, *Commercial Register* speculated delightedly on the consequences, "if after the magnificent and praiseworthy exertions of New York, and in spite of the *apathetic* wealth of Philadelphia, Baltimore, 'little Baltimore' should step in and carry off the prize." [13]

The railroad mania that gripped Baltimore reached its peak when construction began. On that celebrated day, July 4, 1828, the Baltimore *American,* in an appropriate poem, admitted that all was not entirely sane in the city and gloried in the fact:

Song for the Day

Chorus—O we're full of life, fun and jollity
We're all crazy here in Baltimore
. . . . . .

And when the road is made
With the Pick and the Spade
In the locomotive Engine they will put a little fire,
And while the kettle boils
We may ride 300 miles
Or go to bed in Baltimore, and breakfast in Ohio!
. . . . . [14]

What was the source of this remarkable faith in a new and untried mode of transportation? The newspaper comments provide an unambiguous answer. "The character, energy and enterprise of the highly respectable gentlemen who have undertaken the business are the surest guarantees to the public that, with proper legislative aid and the co-operation of the citizens the plan must succeed . . ." remarked the Baltimore *Gazette* on February 23. The Baltimore *American* of February 26 commented that the favorable reception of the proposal flowed "as well from the character of the promoters, as from the evidence recently accumulated from various quarters, on the efficacy and cheapness of rail-road communication." [15] Comments in other cities also stressed the reputation of the promoters. The Boston *Daily Advertiser*—principal supporter of the railroad idea in Massachusetts—considered the important thing to be the confidence in the enterprise evidenced by Baltimore's wealthy citizens.[16] Most interesting of all was the reaction of a Philadelphia newspaper which had opposed the full railroad for Pennsylvania:

> As to the practicability, at an advisable cost, of what Baltimore has undertaken, we do not, now, pretend to decide; but the presumption is, doubtless, in the affirmative, from the manner in which the enterprise has been considered and patronised. . . . So many gentlemen of vigorous and sober minds, large fortunes, and various responsibility, as appear at its head, would not have embarked in it without having studied it well, and discovered grounds, very plausible and otherwise encouraging, for proceeding as earnestly and confidently as they do.[17]

Clearly, the popular faith in a strange and untested method was based upon faith in the leadership of wealthy men, who, by investing their own capital and proceeding on their own, gave concrete evidence of their own faith in the project. This was the factor that made possible a railroad mania less than two years after completion of the Erie Canal. In accordance with the nature of mania, it was the result, not of careful reasoning, not of intense propaganda and debate alone, but of a dramatic example that provided a symbol of certainty in a situation that was actually highly uncertain. To the Pennsylvanians, the dramatic example was provided not by the merchants of Philadelphia—they were too cautious—but by the leadership of another state, a state whose problems were different from those of Pennsylvania. The Philadelphia merchants who constituted the leadership of the Pennsylvania improvement movement later justified their policies by contending that they had had no choice; that the population had been temporarily aroused from a habitual lethargy only by the success of the Erie Canal and would, therefore, give its support only to the tried and certain canal method. But the population of Baltimore, presumably in need of certainty, were fortunate in having it provided for them by a daring domestic leadership whose technical method could be determined by Baltimore's own situation.

That this difference in the behavior of the two leaderships reflected a difference in their attitudes toward uncertainty is evident from their differing emphases upon the need for experience. Placing far less reliance upon the experience test, the merchants of Baltimore were less influenced by the Erie Canal analogy and could therefore maintain over the years a more realistic attitude towards the difficulties of their canal to the west. Then, when confronted with the railroad alternative, they did not demand experience; unlike the Pennsylvanians, they did not require as a prerequisite for action a complete testing by others. Indeed, in comparison to the Pennsylvania discussion, the references to railroad experience in the proceedings of the Sundry Citizens were remarkably brief. Their committee explained that

> Rail Roads had, upon a limited scale, been used in several places in England and Wales for a number of years [and were successful]. . . . The idea of applying them upon *a more extended scale* appears however only recently to have been suggested in that Country.

[12] **32**: 34, March 27, 1827.

[13] Quoted in the Baltimore *Patriot,* March 24, 1827.

[14] Quoted in [William Prescott Smith], *A history and description of the Baltimore and Ohio Railroad . . . by a Citizen of Baltimore,* 131, Baltimore, 1853.

[15] See also, Baltimore *American,* March 1, 1827; and *Niles' Weekly Register* **32**: 340, March 17, 1827.

[16] Quoted in Baltimore *Patriot,* March 23, 1827.

[17] *National Gazette,* quoted in Baltimore *Patriot,* April 7, 1827.

But in the short time since, the committee declared, the advantages of railroads "even over canals" had become so clear that two thousand miles were completed or in rapid progress in Great Britain. The committee had to admit that only one railroad—the Quincy—was constructed and fully tested in the United States, and that it was only three miles long. But it was successful, had proven that railroads were not injured by severe frosts, and while it had cost $11,000 per mile, "it is alleged" that, with the experience gained, a similar one could be constructed for one-third less. The committee's brief references to experience concluded as follows:

> The stock of information upon the general subject of Rail Roads now in possession of this Committee is admitted not to be very extensive, but they have gleaned from the several publications and reports which they have examined . . . enough to leave no doubt upon their minds, that these roads are far better adapted to our situation and circumstances, than a Canal across the Mountains would be. . . .[18]

Nowhere in the pamphlet, nor later in the newspapers, was there a reference to the issue that had loomed so large in the Pennsylvania debate: whether there existed at all a record of experience with a successful general-purpose railroad. Hence Baltimore's decision was a "step in the dark," of the kind that the Pennsylvania mainline leadership had abjured. The Baltimoreans took that step long before they could be at all certain that the railroad was adapted to their circumstances: "Although much has been done in Great Britain to render railroads and their concomitant engines available to the purposes of transportation," wrote Minus Ward two months after the railroad decision, "it will be admitted that much remains yet to be done . . . to render them capable of being adapted to the bolder geological features of our own country, and to the severity of our winters. . . ."[19]

In the absence of adequate experience, the Baltimore merchants, like the Pennsylvania railroad advocates, relied upon the optimistic assumption that the rapid technological pace of the past would continue. "The difficulties . . . are great," wrote the United States engineers who first surveyed the routes for the Baltimore and Ohio,

> . . . but we have met with none which we do not think that we even now perceive the modes of successfully overcoming; and when science and experience shall have increased our resources, we may reasonably expect, that with their aid, these obstacles will diminish to a much lower point than that at which we have now estimated them.[20]

There is still another difference between the Baltimore and Pennsylvania attitudes. While the population was widely enthusiastic, the published proceedings of the two meetings of the Sundry Citizens—their only formal propaganda effort—gave an impression of cautious and sober leadership. There is none of the extreme and unrealistic optimism so common in the Pennsylvania mainline literature. They did not, for example, claim the trade of the entire west for their railroad: "we must be content to share this trade" with New Orleans, the Citizens admitted, "but from a Country of such vast extent, and whose productions are so various and of such incalculable amount, there will be a sufficient Trade to sustain both New Orleans and Baltimore."[21] These smaller claims, one suspects, reflected a greater confidence.

However, this important difference between the two cases has to be carefully limited. It appears only in comparisons of the more official public documents. In other respects, that impression of sober realism, on which the people of Baltimore based their faith in railroads, was illusory. Those wealthy merchants made their decision and began construction in an enthusiastic atmosphere far more appropriate to a fair than to a counting house.

> As soon as the grading was completed for a mile west of Mount Clare, the iron strap, then called a rail, was laid down and a car was built, not unlike a country market wagon, without a top. . . . In this car Charles Carroll of Carrollton, Alexander Brown, William Patterson, Philip E. Thomas, and others of the directors of the Company, with some leading citizens of Baltimore, made trips backwards and forwards, drawn by a single horse, with the same elation that we now see among the boys who are lucky enough to secure a ride on the platform of a passenger car as it passes along the streets.

Thus did Latrobe, in his nostalgic memoir, describe the dawn of the railroad age. His nostalgia is catching, for "There was a verdant freshness about railroad things in those days that is wonderful to recollect." When Ross Winans produced his invention for the axles of railroad cars, "the town went wild with 'the Winans friction wheel.'" Baltimore's celebrity, Charles Carroll, signer of the Declaration of Independence, seated himself in a little car in one of the upper rooms of the Baltimore Exchange and was drawn by a remarkably tiny weight attached to a string which passed over a pulley and dropped into the hall below. "Around him were all the prominent men in Baltimore, and all were as much pleased as children with a new toy."[22]

These prominent men, so sober and seemingly realistic in their public pronouncements, betrayed in their private letters all the symptoms of a railroad mania. Alexander Brown wrote to England that the railroad "will resuscitate Baltimore, and from the immense advantage of local situation will make her in a short time

[18] *Proceedings of the sundry citizens,* 6–8.

[19] *Remarks, propositions and calculations relative to a railroad . . . from Baltimore to the Ohio River,* 12, Baltimore, April 1827.

[20] Quoted in Maryland, House of Delegates, Internal Improvement Committee, *op. cit.,* 275, 1828.

[21] *Proceedings of the sundry citizens, op. cit.,* 5.

[22] Latrobe, *op. cit.,* 12–13.

second to no city in the union." [23] And all this would be accomplished, he thought, with very few serious difficulties: "the judicious *location* of a Rail Road, *and the application of a moving power upon it,* constitute the only really difficult part of the system. . . ." [24] He was referring so cavalierly to the difficulties of constructing the world's first long-range, general-purpose railroad, a project far exceeding in magnitude anything then being considered in advanced, industrial England.[25]

On such a project, construction had to be experimental. The engineers had to learn from bitter and expensive experience the effect of curves on the wear of axles and wheels; the grades that a locomotive could handle; the great superiority of the locomotive over the horse; the superiority of wood structures over costly granite ones; the advantages of the edge rail resting on wooden cross-ties over the flat rail laid on a continuous stone, iron, or wood support; the necessity of putting flanges on the inside, not the outside of the wheel; even the need to figure out a method of drainage before proceeding with a deep cut. These bold projectors of a railroad across the Alleghenies did not even realize at first the necessity of winding around mountains. An early plan, fortunately never attempted, called for a line running straight as an arrow over the entire mountain range.[26]

These were the gropings of the pioneers of a new technique. Lacking relevant experience, they had to depend upon the general published works on the subject, much like the builders of the Erie Canal a decade before. Two and one-half years after the railroad decision, Alexander Brown was complaining of a deficiency of mechanical knowledge in his chief engineer "except as he has had from books." [27] These pioneers, again like the builders of the Erie Canal, taught the men who were to spread the new technique throughout the country. "It will not be saying too much . . . ," wrote the *American Railroad Journal,* "to denominate them the Railroad University of the U. S." [28]

But in this university the students paid no tuition and the lessons were extremely costly. Miles of iron flat-bar rails were laid on very expensive continuous stone foundations before it was discovered that such rails broke too easily and that the rigidity of the stone foundation was wrecking both rails and cars. Nor was the magnitude of these problems unforeseeable. Only a group of men inspired by mania could have ignored the difficulties of so original a project on so large a scale. As in the Pennsylvania case, the situation dictated not immediate construction—and especially not projection all the way to the Ohio River—but postponement of the large project until small-scale experiments had been made. As the *American Railroad Journal* put it in 1848:

> Had Baltimore delayed the commencement of her railroads a few years as did Boston—until the subject was better understood—until others had made the necessary experiments . . . it is probable that with the same outlay already incurred, her noble works would now be much nearer completion than they are.[29]

We must conclude that the Baltimore decision for immediate railroad construction had as little of the rational about it as the Pennsylvania decision for immediate canal construction. The Sundry Citizens were far more daring than the railroad enthusiasts of Pennsylvania, for the latter advocated postponement in order to await the outcome of the British railroad projects. And the Baltimore proposal was amazingly uncompromising: not only was the alternative of a cheaper and less risky branch railroad to the Chesapeake and Ohio Canal rejected, but even the common attempt to limit losses in this new field by building at first a single pair of tracks was evidently not even considered. It was to a be a double railroad and it was to go all the way.

Why did they not postpone the project? In the Pennsylvania case the decision for immediate construction was attributed to two factors: a panic reaction to the Erie's completion and a belief that the project could obtain sufficient support only under the impact of the Erie's success. There is no evidence for the latter belief in Baltimore, but there was good reason for a sense of urgency. Of the three rivals of New York, Baltimore had experienced the most rapid rate of growth before 1815 and the most severe check to growth in the following decade. The check was administered principally to the city's trans-Allegheny trade, first by the introduction of steamboats on the Ohio and the Mississippi rivers, then by the success of the Erie Canal. The city's textile trade was particularly hard hit because, on the one hand, western production of fabrics increased after 1815; on the other hand, western dealers found it almost as easy to get to New York's larger market as to get to Baltimore. These factors, operating after 1818–1819, produced what was for Baltimore an entirely new experience: a perceptible reduction of the rate of growth. Baltimore's superior position in the Chesapeake Bay and Susquehanna River

[23] *The early correspondence of Alex. Brown and Sons . . .* , 4, letter dated February 24, 1827, to William and James Brown and Company, Liverpool.

[24] *Ibid.,* 6, letter dated March 3, 1828.

[25] See Cohen, *op. cit.,* 538.

[26] Latrobe, *op. cit.,* 7, 10–11; [Nathan Hale], Poussin on American Rail-roads, *North American Review* **44**: 454–455, 1837; Cohen, *op. cit.,* 542–547.

[27] Cited in Kent, *op. cit.,* 117–118. Letter dated January 12, 1829, to William Brown in Liverpool.

[28] November 28, 1835. Quoted in Joseph Snowden Bell, *The early motive power of the Baltimore and Ohio Railroad,* 2, New York, Angus Sinclair, 1912. The chief engineers of the Boston and Worcester and the Boston and Providence Railroads at the time of their construction had been trained on the Baltimore and Ohio. See Edward C. Kirkland, The railroad scheme of Massachusetts, *Jour. Econ. Hist.* **5**: 168, November, 1945.

[29] **21**: 258, April 22, 1848.

area continued to assert itself—four-fifths of the trade of the region flowed through the city—but the key to further growth, the trans-Allegheny trade, was evidently slipping out of Baltimore's hands.[30]

No one was more clearly aware of these problems than the central figure in the railroad project, Philip E. Thomas. In January, 1827—a month before the decision for the railroad—he signed, as chairman of a citizens' committee for a Baltimore-Susquehanna canal, a report that was remarkable for a feeling of desperation that verged on the morbid. The decline of a city once it has begun, the report warned,

> is as rapid as that of the human body towards dissolution, when in a state of decay . . . wealth is withdrawn—enterprise emigrates, and her resources one by one fail, until at length her commerce gasps its last gasp, and she sinks into nothingness, to be remembered only, with the things of the past.

This was the fate of any city that delayed action at a crucial moment.

> Our citizens might smile at such examples as applied to themselves, *yet the smile of confidence and security is too often the characteristic of those who are on the eve of calamity and destruction.*[31]

There was good reason for Baltimoreans to believe that gradual deterioration—this was their term for a slowing down of the rate of growth—would soon turn into rapid strangulation. For Baltimore, like Philadelphia, felt surrounded by the projects of her competitors. Consequently, the Sundry Citizens, in announcing their railroad decision, urged the absolute necessity of immediate action:

> Whilst the Cities of Philadelphia and New York are making such great and efficient exertion to draw to themselves the trade of the West, it cannot be expected but that Baltimore must soon lose the comparatively small portion which remains to her of this trade, should she continue inactive. . . .[32]

In both cases, then, the extreme sense of urgency explains in part the irrational element in the decisions—the refusal to postpone when postponement offered great advantages. However, the evidence in the Pennsylvania case is direct—we have the detailed public debate and postponement proposal; in Baltimore, where the discussions were conducted privately in merchant homes, the importance of the panic factor must be largely inferred from the situation. In any case, it is clear that the situation did not justify immediate construction—neither the cautious construction of a canal nor the daring construction of a railroad. For a rational approach we turn hopefully to Massachusetts.

[30] See The Baltimore and Ohio Railroad, *North American Review* **25**: 63–64, 1827.

[31] *Report* of the Baltimore-Susquehanna Canal Committee, dated January 6, 1827, in Baltimore *American*, January 8, 1827. See also Maryland House of Delegates, Internal Improvement Committee, *op. cit.*, 269–270, 1828.

[32] *Proceedings of the sundry citizens . . .*, 4–5. See also the resolution of the Baltimore Internal Improvement Convention of December 1825 in *Niles' Weekly Register* **29**: 328–329, January 21, 1826.

PART III. MASSACHUSETTS

VIII. THE CANAL VERSUS THE RAILROAD

Only Massachusetts, of our three cases, delayed construction of a transmontane line for some time after completion of the Erie Canal. Consequently, a longer period and a number of decisions must be described. The rejection of the canal method by the state's improvement leaders at the beginning of 1827 was the first of these decisions; it provides a second comparison with the corresponding discussion and opposite decision in Pennsylvania the year before. In some respects this comparison is more suitable than the one between Baltimore and Pennsylvania. For in both Massachusetts and Pennsylvania the debates were public—the goal was state construction—whereas in Baltimore the crucial discussion was carried on within a small group and therefore lost, in good part, to the historian. Furthermore, both states were in a position to construct either a canal or a railroad to the west through their own territories—the short westernmost section of the Massachusetts line that had to cross New York territory to reach the Hudson was relatively unimportant—whereas Baltimore had to watch from the sidelines and acquiesce in the canal plans of others. A second decision, for private construction of a railroad to Worcester, came in 1830, after the Rainhill Trials in England and the operation of the Liverpool and Manchester had decisively proven the practicability of the general-purpose railroad. Finally, the decision to build a transmontane railroad under private auspices was made with much doubt as to the outcome in 1836, nine years after the Sundry Citizens of Baltimore had optimistically projected their railroad to the Ohio River.

Again we are confronted with contrasts in behavior under similar conditions and again we shall ask the same questions: to what extent may the differences in behavior be attributed to differences in objective circumstances; to what extent may they be attributed to differences in the subjective traits of the decision-making groups?

THE CANAL AND RAILROAD PROPOSALS TO FEBRUARY, 1827

As in the case of the corresponding Pennsylvania and Potomac projects, a canal from Boston to the Hudson River was first proposed in the late eighteenth century. In 1791 a group under the leadership of General Henry Knox surveyed a route from Boston as far as the Connecticut River and received a state charter under the name of "The Proprietors of the Massachusetts Canal." But a project of this magnitude was far beyond the means, not only of the projectors, but of a state that was just recovering from the Revolutionary War. The charter lapsed and the idea lay fallow for more than three decades.[1]

Again as in the case of the corresponding Pennsylvania and Potomac projects, the revival of the Massachusetts project coincided with the demonstrated success of the Erie Canal. But things moved more slowly in Massachusetts. Although Governor William Eustis called for a canal to the western part of the state in his message of January 6, 1825, he also warned that the condition of the Massachusetts treasury ruled out a large expenditure on improvements. He hoped that in the future the state might be able to assist "enterprising and spirited individuals" who might engage in improvements. In the meantime, if the legislature "be disposed to pay attention to the subject at their present session," it might appoint, for temporary employment only, an engineer to make surveys of such routes as the legislature might suggest. The Governor was evidently immune to canal fever.[2]

The merchants of Boston, however, were seriously alarmed by the approaching completion of the Erie Canal. Hence in February, 1825, the month in which the majority of the Pennsylvania Canal Commissioners announced the practicability of a full canal to the west, the Massachusetts legislature provided for the appointment of three commissioners who were to ascertain the practicability of a canal from Boston to the Connecticut River and of an extension from there to the Hudson at some point near the Erie Canal. Nathan Willis, Elihu Hoyt, and General Henry A. S. Dearborn were appointed commissioners; the engineer was the well-known and highly reputable Colonel Loammi Baldwin, II, son of the Loammi Baldwin who had built the Middlesex Canal.[3]

As in Pennsylvania, the railroad alternative appeared concurrently with the first steps towards the canal. In May, 1825, an internal improvement meeting in Concord, New Hampshire, in which several Bostonians participated, called for a canal across New Hampshire to connect the Connecticut River with the Merrimac and the ocean. The meeting admitted that there were doubts of the feasibility of a canal over the watershed between the Merrimac and the Connecticut and sug-

[1] Hodge, Charles L., Economic beginnings of the Boston and Albany Railroad, 1831–1867, in *Facts and factors in economic history*, 446–447, Cambridge, Harvard Univ. Press, 1932; Adams, Charles Francis, Jr., The canal and railroad enterprise of Boston, in *The memorial history of Boston* **4**: 112, Boston, Osgood and Co., 1883.

[2] In *Massachusetts acts and resolves, 1824–1828*, 86–89; Bliss, George, *Historical memoir of the western railroad*, 3–4, Springfield, Mass., Samuel Bowles, 1863.

[3] Bliss, *op. cit.*, 3; Hodge, *op. cit.*, 447. On Baldwin, see Frederick K. Abbott, The role of the civil engineer in internal improvements: the contributions of the two Loammi Baldwins, father and son, 1776–1836, unpublished dissertation, Columbia Univ., 1952.

gested that a railway might solve the difficulty.[4] Then in June the new Governor, Levi Lincoln, much more susceptible to the spirit of the age than his predecessor, declared that the success of the New York canals was "illustrative of the advantages of similar enterprises elsewhere" and reminded the legislature that Massachusetts had been first with the Middlesex Canal, which, though it was unprofitable to its owners, had produced great public benefits. Then he remarked, rather casually, that the railroad had been suggested as a possible alternative to the canal. It was "approved in practice" in England, he had been assured, but it was not yet determined whether the severe frosts would permit its use in Massachusetts. He suggested an "experimental comparison" in case they turned out to be feasible.[5] No action followed the suggestion; the commissioners continued the canal survey. But public interest in the railroad developed rapidly, as it had done in Pennsylvania after the February, 1825, Canal Commissioners' reports.[6]

The commissioners and Loammi Baldwin reported in January 1826. From Boston to the Connecticut River the canal would be 100 miles long, have a lockage of 1,959 feet, and cost a maximum of $3 million. The extension from the Connecticut to the Hudson near Troy would be 78 miles long, would require 1,322 feet of lockage and a four-mile tunnel through Hoosac Mountain, and would also cost $3 million. Thus the total rise and fall from Boston to the Hudson was estimated at 3,281 feet. Baldwin obtained his $6 million total cost estimate by assuming a cost of $10,000 for each mile of canal, plus $1,000 for each foot of lockage, plus $920,832 for the tunnel. Evidently no instrumental surveys were made west of the Connecticut River.[7]

The commissioners devoted a good many pages to a defense of the two most troublesome aspects of their proposal: the enormous total rise and fall and the tunnel through a mountain. They cited some examples of high-summit canal projects, but the only one mentioned that came close to their own was the projected Chesapeake and Ohio, with its estimated 3,837 feet of lockage. As for the tunnel, they cited many already constructed in England and on the continent, and pointed to the Pennsylvania Canal Commissioners' recommendation of a four-mile summit tunnel on their proposed mainline. Thus did one unrealistic project give the semblance of reality to the other.[8]

But the primary example was the Erie Canal. Because of it, the success of a Massachusetts canal could not be doubted: "To bring this theory to the stern test of facts, it is only necessary to advert to the practical results, which the canals of New York abundantly furnish." They quoted the projections in the last report of the New York Canal Commissioners: by 1836 the canal fund and the tolls would extinguish the canal debt and leave an annual revenue of $1,525,000; in 1846, the canal revenue would be $2 million; in 1856, $4 million; in 1876, more than $9 million. This was proof enough: "It will naturally be inquired, have we a right to anticipate equally as flattering results, from the like undertakings, in Massachusetts? And why not?" The rhetorical question was followed by still more data on the toll revenues of the Erie.[9]

Thus the Erie Canal's success was used to justify still another canal project over the mountains. But in one aspect, the analogy was more applicable to Massachusetts than to the other areas; a Massachusetts canal, unlike the others, would be linked to the Erie. All the enormous advantages of the Erie in regard to inland navigation would become the advantages of Boston as well. The commissioners took full advantage of this: their canal, they pointed out, would connect Boston harbor with the Great Lakes; with the Ohio, the Mississippi, and the Missouri, together with their tributaries; with the Ohio Canal, then under construction; and ultimately with the Gulf of Mexico. Half a continent, now in New York's grasp, would have to be shared with Boston. "It is but to name these overwhelming facts to convince incredulity and refute objection. . . ." [10]

But, given the canal, would Boston be able to compete with New York? The commissioners were certain that it would. Firstly, from Troy the distance to Boston was about the same as the distance to New York; secondly, goods on the Erie Canal had to be transshipped to Hudson River sloops, whereas they could continue directly on a Massachusetts canal; thirdly, the route by sea and the Hudson River to Albany was "long, dangerous and expensive even in peace, and in war subject to nearly total interruption"; and fourthly, Boston could count on a large proportion of the western produce on the Erie because she could offer in return, on better terms than New York, a wide variety of domestic manufactures and foreign imports. The commissioners' evidence for all this was the size of the current trade between Albany and New York; it was only an indication of what it could be if a direct means of transportation to Albany were provided.[11]

For so important a project, the commissioners recommended state construction. They doubted whether a work so extensive, costly, and permanent, one that involved so many interests "of a local, private and public

[4] Harlow, Alvin F., *Steelways of New England,* 18–19, New York, Creative Age Press, 1946.

[5] Annual Message, June 2, 1825.

[6] See Hodge, *op. cit.,* 448; Bliss, *op. cit.,* 4.

[7] Hodge, *op. cit.,* 447; *Report of the Massachusetts Commissioners on the routes of canals from Boston Harbour to Connecticut and Hudson rivers,* 108–110, 148, Boston, 1826. The commissioners' report appears on pages 1–64 and 148–185; Baldwin's report appears on pages 65–147.

[8] 152–160.

[9] 161.

[10] 167–169.

[11] 169–171.

nature," and one that had such a "powerful and lasting effect upon the great mass of people" should be accomplished by an incorporated company.[12]

As in Pennsylvania and Baltimore, the canal advocates utilized the stick of competition as well as the carrot of enormous returns. What would happen, the commissioners asked, if Massachusetts did not immediately proceed at least with the canal to the Connecticut River? "Massachusetts will inevitably take a retrograde course." Boston was floundering; it was threatened not only by the great projects of other states but by improvements within Massachusetts itself. "Let us hasten then, to embark upon the flowing tide of universal enterprise and prosperity . . . guided by that 'spirit of improvement which is abroad upon the earth,' we cannot fail to be borne triumphantly along."[13]

The commissioners' recommendations received the full support of the Governor. In his annual message of January 4, 1826—a week before issuance of the report—Governor Lincoln announced that the report would put the practicability and profitability of the canal beyond all doubt. It might be going too far to claim that the "pecuniary profit" of a canal from Boston to the Hudson would be proportionate to that of the Erie, the Governor conceded, but there could be no doubt of its great success. His reasoning was identical with that of Mathew Carey in Pennsylvania. It is "an axiom in political economy," he declared,

> that wherever a Canal can be feasibly located, through a country furnishing of itself the means of business, by the cultivation of fertile fields, or the occupation of water power, or the product of valuable minerals; or if by communicating with other regions of population and trade, it will open for domestic produce new and better markets, the work may advantageously be constructed.

Then came the stick: the project was the state's only hope. He warned of the steady deterioration of Boston's situation. The trade of the Berkshire hills and the Housatonic valley was going up the Erie Canal or down the Hudson to New York. The Connecticut River, soon to be improved, and the Blackstone Canal, then building, would soon draw the trade of the interior of the state to New Haven and Providence, and thence to New York City. Thus Boston, isolated from the west, was being isolated from its own state as well. These projects could not be opposed, the Governor declared; they were part of the improvement spirit that was enriching the country. But their effects could be countered. Now that the canal was declared practicable, the state had the most pressing motives for immediate action. The Governor requested further surveys, either by the commissioners or by a permanent internal improvement board, to determine definitely the route, to find possible new sources of water, and to investigate the possibility of building other improvements—"bridges, roads and railways as well as canals."

There was no other reference to railways. Evidently, the Governor had suggested the possibility of an east-west railroad in the previous June because no one knew at the time whether a canal was practicable. Now the issue seemed settled. However, on the very day the Governor delivered his message, the Boston *Daily Advertiser* stepped into the fray. Its editor, Nathan Hale, discussed the commissioners' report without knowledge of its details—it was not published until mid-February—but on the understanding that the report declared the canal practicable at great expense. The expense, Hale pointed out, was caused by an amount of lockage that was greater than on any existing canal in the world. As the engineer could not have had time to survey the entire route thoroughly, the editor, like the Governor, urged further surveys. But the editor remained uncommitted to a particular mode of transportation: the commissioners "may also think it expedient to extend their inquiries to the subject of railways, before adopting any decisive measures. . . ."

On February 11, Hale, still without the report, maintained his neutrality, but stressed the advantages of the railroad. According to his information from England, the railroad was far better adapted than the canal to the needs of the state. Massachusetts had long winters; the railroad operated all year round. Massachusetts was mountainous; the railroad, which cost half as much as a canal in areas with an average amount of lockage, cost proportionately less in mountainous areas because its means of overcoming elevations were far less expensive than were locks on a canal. Finally, the railroad, like the canal, would be available to all; Hale believed that anyone would be able to use the line, simply "by having wheels for his cart fitted to the railroad." But with all these evident advantages, Hale still stressed the fact that information in the United States on this subject "is not such as to enable anyone to decide with confidence. . . ." He recommended only "inquiries" and "some experiment for the purpose of testing expense."

On February 17, Hale was able to comment on the basis of the published report of the commissioners. He was favorably impressed: although many of the necessary surveys were not completed, it was definitively determined that there was an abundant water supply on at least one route from Boston to the Connecticut River. The value of such a canal, he pointed out, was to be greatly enhanced by the project for the improvement of the Connecticut River; as the river below the projected canal was winding and therefore longer than the canal would be, the river's trade would undoubtedly be drawn to Boston. Thus, Hale was not dogmatic; he was willing to consider a canal to the Connecticut, but wanted railroad investigations too.

But the commissioners recommendation of a canal

[12] 174.
[13] 182–183.

over the Berkshires, like the corresponding recommendation of the Pennsylvania Canal Commissioners, met with a good deal of scepticism. David Henshaw, a prominent Democratic politician writing in the Boston *Courier,* calculated that the tunnel proposed by the commissioners would take between 52 and 182 years to build, depending on the assumptions. The same point had been made in Pennsylvania regarding the canal tunnel proposal there—a very limited group of men could work in a tunnel at any one time, and excavation methods were primitive.[14]

Evidently the legislature was also sceptical. It tabled a resolve authorizing further surveys; it repealed the resolve under which the past surveys had taken place; and while the Senate passed a resolution for an investigation of railroads by a commission, the House indefinitely postponed it. The legislators' motives were not stated; probably they were thoroughly alarmed by Baldwin's six-million-dollar cost estimate.[15]

While the legislature stalled, railroad interest, as reflected in the daily press, began to gather momentum. A letter in the *Advertiser* of February 13 from "A Boston Merchant" analyzed the competitive advantages of a railroad to the Hudson. Admitting that transportation between Boston and Albany by railroad would be more expensive than between New York and Albany by river, he contended that Boston could nevertheless compete for the northern and western trade. For the city had always been able to sell goods at as low a rate as any in the country and could afford to pay a higher price. Furthermore, the railroad would have a monopoly of the trade during the winter months. ". . . let Massachusetts . . . effect by *art* what others have acquired by *nature*. . . . If we sleep much longer, Boston will sink, in a commercial view, into comparative oblivion."

Beginning in February, the daily press began to carry reports of the progress of railroads in Great Britain, together with technical descriptions of locomotives, tracks, and roadbeds.[16] Perhaps more impressive was the report in the *Advertiser* of a petition to the New York legislature for incorporation of a railroad between Schenectady and Albany. To build a railroad on the route of a successful canal was something new in the United States and would constitute, the *Advertiser* thought, a real test of the relative advantages of the two modes of transportation.[17] The paper also reported John Stevens' successful locomotive demonstration in Hoboken on a circular track whose curve was much sharper than any that would be encountered in practice.[18]

But a contemporary event in Massachusetts itself was to have far greater influence. The very legislative session that heard the report in favor of a canal granted a charter to the Granite Railway Company. Gridley Bryant, a builder by trade, a self-taught engineer, and a close follower of railroad events in Great Britain, had been given the contract for supplying the stone for the Bunker Hill Monument. He decided to use a horse railroad to haul the granite the three miles from the quarries at Quincy to the Neponset River. With much difficulty because of scepticism and prejudice in the legislature, he obtained the charter on March 4, 1826, began construction in April, and opened the railroad in October. The *Advertiser* hailed the experiment as the first in the United States, one that would demonstrate "the manner and cost of such structures. . . ." [19]

Governor Lincoln's next message on June 6, 1826, reflected the growth of railroad interest. He backtracked on his emphatic January recommendation of a canal by claiming to have been misunderstood: he had not urged a "precise and exclusive character of improvement," only further investigations.

> Much diversity of opinion is known to prevail. . . . *Canals* and *Railroads* have each their respective advocates, while probably, the election of either, in most cases, must be decided entirely by a regard to the face of the earth over which their construction is proposed.

Only a few paragraphs later, however, the Governor could not forbear from indicating his true opinion: "the more extended and beneficial influences of Canals in the general improvement of Country, seem to me too important and decisive to be lightly disregarded." The railroad, he declared, was a mere "*passage way* for travel and transportation," while canals create other opportunities as well: their reservoirs and feeders could provide irrigation for the surrounding land and a more dependable water supply for industries. Furthermore, all the railroad's many advantages might be more than counterbalanced by the greater ease of passing on canals and the superiority of boats over railroad cars for the carrying of heterogeneous products. But the Governor quickly returned to impartiality; he assured the legislature that he meant no discouragement to the construction of railways, it was only that he wanted "correct and definite opinions" on the question. "While uncertainty exists, and different modes of improvement without distinction or discrimination in the circumstances of their application find preferences with different minds, little will be attempted, and nothing successfully accomplished." The Governor again recommended creation of a permanent Board of Commissioners to investigate both canals and railroads.

[14] See Adams, *op. cit.* 4: 115. Baldwin's tunnel proposal was carried out fifty years later when the Hoosac Mountain railroad tunnel was opened precisely at the point he had indicated, but at a cost that was ten times his maximum estimate.

[15] See Bliss, *op. cit.,* 5–6; Adams, *op. cit.* 4: 116.

[16] See the Boston *Statesman* of February 24 and 25, 1826; the items cited in Harlow, *Steelways,* 28–31; and the Boston *Daily Advertiser,* July 26, 1826.

[17] February 23 and June 23, 1826.

[18] May 16, 1826.

[19] March 16, 1826; Adams, *op. cit.,* 4: 116–119.

This time the Governor obtained some action from the legislature, but not of the impartial kind he had asked for. On the petition of Thomas H. Perkins and others, Abner Phelps moved that a joint committee be appointed to sit during the recess and consider "the practicability and expediency" of a railroad to the western line of the state, and from there to the Hudson at or near Albany if New York's permission could be obtained. The motion passed the House in June, 1826, but the Senate refused to concur and the House decided to proceed with its own committee. It consisted of two Bostonians, Abner Phelps and George W. Adams (son of John Quincy), and Emory Washburn of Leicester (afterwards of Worcester).[20]

The Phelps Committee was to report the next January. In the meantime, Gridley Bryant's Granite Railway, which began successful operations in October, helped to bring railroad interest in Massachusetts to a peak by the end of 1826. Berkshire County became so intrigued with the method that one of its citizens, R. F. Morgan, partly on his own and partly aided by local funds, surveyed a railroad route from Albany to Springfield which coincided almost exactly with what was to be the route of the Western Railroad. His report to a mass meeting at Stockbridge on December 21, 1826, advocated a horse railroad, with inclined planes that used either water or oxen as motive power. Although his railroad would have to climb to a height of 1,300 feet above the Hudson, he thought it could be built for $15,000 per mile. His report evidently was received with great enthusiasm. The Stockbridge *Star* reported in January that

> An astonishing degree of anxiety now pervades all classes of our citizens in this region, to see the beginning of this great work. . . . Even the most faithless may be brought out of the labyrinths of ignorance into full conviction of the truth of that, which but yesterday, they condemned as visionary and futile.[21]

At the other end of the state, Nathan Hale, Abner Phelps, and other railroad enthusiasts called a Boston mass meeting. It met on January 10, 1827, heard the report of a committee, passed resolutions for a railroad, and elected a committee to petition the legislature. A petition with 250 signatures was presented to the legislature on January 15. It insisted that the only possible answer to the current projects that would soon draw the commerce of the interior of Massachusetts away from Boston was an east-west communication; and while the contour of the country presented serious obstacles to construction of a canal, those contours were much less formidable impediments to construction of a railroad. The success of the British projects and of the Granite Railroad proved this, the petition asserted. It ended with a request for immediate railway surveys and estimates.[22]

The Phelps Committee presented its report on January 19, 1827. It had done a thorough job with very limited means. Every aspect of the railroad was explored: modes of construction, expense, experience, locomotives, and, above all, advantages over the canal. Some of the information was collected by means of questionnaires sent to citizens throughout the state. The Committee gave two reasons for definitively rejecting the canal: its enormous lockage and its tunnel, which would take too long to build. But even if a canal were feasible, the Committee added, the advantages of the railroad, particularly its all-weather operation, would certainly make it more useful to the state. Unable to make surveys—it had not been granted funds for the purpose—the Committee was nevertheless certain that a railroad across Massachusetts was practicable, because the experience in England and at Quincy proved that mountains were no bar to railways. Several kinds of railroads were described, but the Committee clearly preferred the type used at Quincy, where the rail rested on continuous granite longitudinal supports, which allowed the use of much lighter and therefore cheaper iron edge rails. While locomotives were praised, only horse railroads were described in detail. But the Committee did not make any definite recommendations on mode of construction, for it considered its function to be purely exploratory. Although Boston's deteriorating situation was described, the tone of the report was calm and unhurried. It concluded with a recommendation for the appropriation of $5,000 and the appointment of commissioners and an engineer to determine the practicability and route of a railroad to the Hudson.[23]

TECHNICAL AND COST CRITERIA

Although there was much still to be done before the long-range railroad became a reality in Massachusetts, the Phelps Committee Report did mark the decisive rejection of the canal by the leaders of the state improvement movement. It therefore provides us with another opportunity to test our hypothesis concerning the extraordinary character of the Pennsylvania decision to adhere to the canal method. This Massachusetts decision, like the corresponding one in Baltimore, was taken at the beginning of 1827, a year after the Pennsylvania decision for construction of the mainline. The comparison of the Baltimore and Pennsylvania decision in the preceding chapter demonstrated that they were made on the basis of substantially the same technical knowledge. That this was true of the

[20] Harlow, *Steelways*, 31–32; Bliss, *op. cit.*, 7; Hill, Benjamin Thomas, The beginnings of the Boston and Worcester railroad, *Proc. Worcester Soc. of Antiquity*, 541, 1901.

[21] Cited in Harlow, *Steelways*, 37–38.

[22] *Advertiser*, January 12 and 19, 1827; Harlow, *Steelways*, 40.

[23] Massachusetts House of Representatives, *Report of the select committee . . . on the practicability and expediency of constructing a railway from Boston to the Hudson river, at or near Albany. January 19, 1827.* House no. 13, *passim*, Boston, 1827.

Massachusetts decision as well may be established by examining the series of extensive public statements made during this period by Emory Washburn, Nathan Hale, a Committee of the Citizens of Boston, and the Phelps Committee.[24]

The disadvantages of the canal—its great expense, the immense amount of lockage and the consequent delay in passage, and the long period of uselessness during the winter—were stressed by all. If the railroad was preferred in England, where a canal was closed by frost an average of seventeen or eighteen days in the year, the Phelps Committee argued, how much more should it be preferred "in all the Northern states," where canals were closed an average of 145 days every year? The committee emphasized another disadvantage: the time required for tunnel construction would be immense.[25] Evidently, no one in Massachusetts suggested canal segments linked by a portage railroad.

All but one of these disadvantages of a canal over mountains applied as well to the Pennsylvania canal proposal. The exception was the long season in which the canal would be frozen over. A Pennsylvania canal, considerably south of the Erie, could expect a short monopoly period because of its longer period of operation; a Massachusetts canal would have no such advantage. This was considered an important factor—it was stressed in both the Pennsylvania pro-canal and the Massachusetts anti-canal literature—but it does not seem to be important enough to account, by itself, for the great differences in the reaction to the canal proposal in the two states.

The advantages of the railroad, the Massachusetts writers agreed, depended on the relative ease with which it could handle grades and on its relatively low construction costs. A canal route, Hale pointed out, had to be thirty to forty feet wide, had to be excavated to a uniform depth, and had to be enclosed by waterproof banks. This difficult structure had to be kept at a dead level by means of expensive cuttings and high embankments; and when one level was changed to another, the expensive, clumsy, and delaying lock method had to be used. Finally, the route had to be so chosen as to guaranteee a sufficient amount of water. A railroad route, on the other hand, had to be only eight to ten feet wide, could be built anywhere, and had to be made capable merely of supporting an iron rail on each side of it. Most important, it did not require a perfect level—twenty-five feet or more of elevation per mile was possible—and any steeper incline could be overcome merely by adding extra power.[26] According to the Citizens Committee, steep inclines could be surmounted easily by "zig-zags," hence, if "one horse will draw eight tons upon an elevation of thirty feet in a mile, the highest mountains between Boston and Albany may be easily passed." Washburn was equally optimistic—the railroad "may as well be done upon an uneven surface as any other"—but he discussed the problem in more detail. He admitted that the English railways used the expensive and inconvenient method of inclined planes and stationary engines to surmount steep grades, but he was certain that this would be unnecessary in Massachusetts. His certainty was based principally upon an implicit faith in the continuation of the rapid technical advance that had marked recent railroad history. But he also tentatively suggested some likely expedients. On a horse railroad, the steeper grades could be surmounted, he thought, by dividing the cars among two or more horses. The method would cause delay, but since one horse on a railroad would be able to transport as heavy a load from Boston to the Hudson as eight horses upon a common road, there would be immense savings. On the other hand, if locomotives were used, "all difficulties arising from our hills would be entirely abated." The railroad would simply wind around the hills. For a railroad, Washburn pointed out, could be made in any direction—its route was not controlled by the need for feeders and reservoirs. The turnpike between Philadelphia and Pittsburgh, for example, managed to cross the Alleghenies with only gradual ascents, and Washburn saw no reason why this could not be done on a railroad from Boston to the Hudson.[27]

Construction cost estimates depended of course on the type of railroad considered necessary. The Phelps Committee defined a railroad as simply a carriage road equipped with rails, described favorably a monorail system suggested many years before by Colonel Henry Sargent of Boston, then turned its attention to the English experience. There, according to the Committee, they generally built double railroads with periodic switch arrangements between the two sets of rails to permit passing. Either a flat or an edge rail was used there, but the Committee rejected the flat rail as too expensive and too easily broken. The edge rails, of either wrought or cast iron, were attached to stone blocks sunk in the road. This type of road

[24] The statements will be referred to as follows. Washburn: a series of articles by Emory Washburn, published during November and December, 1826, in the Worcester *National Aegis* under the pseudonym "Agricola." Citizens Committee: Report of a Committee of the Citizens of Boston, on the expediency of a rail road from Boston to the Hudson River, signed by Russel Jarvis, William Foster, Samuel Austin, Jr., Abbott Lawrence, and Andrew J. Allen, published in the Boston *Daily Advertiser* of January 13, 1827. Hale: [Nathan Hale], *Remarks on the practicability and expediency of establishing a rail road on one or more routes from Boston to the Connecticut River,* Boston, 1827; the pamphlet consists of "slightly corrected" articles from the Boston *Daily Advertiser* of January and February, 1827. Phelps Committee: Massachusetts, House of Representatives, *Report of the select committee . . . January 19, 1827,* Boston, 1827.

[25] Phelps Committee, 25–28, 29–31.

[26] 9–10. This was also the position of the Phelps Committee, 4–5, 7, 24.

[27] December 13, 1826.

was considered best in England, the Committee testified, but there were serious objections. The rails had to be short and the number of joints made them uneven; they sometimes broke for lack of support between the stone blocks, and the blocks themselves were easily displaced because they were not connected to each other.

The cost of this kind of railroad in Great Britain, was, according to the Phelps Committee, £2,000 to £6,000 per mile. The Liverpool and Manchester, which was recently granted a charter, cost £12,000 per mile, but this included the expense of land, warehouses, steam engines, etc. Making deductions for these, the Committee estimated the cost of a mile of the Liverpool and Manchester, double-tracked, at £4,000. The Committee had made other calculations: it estimated the cost of the railroad from Newcastle to Carlisle at £3,915 per mile; and a combined estimate for a selected five hundred miles of British railways came to £4,000 per mile, but "all the modern improvements and extra expense" raised it to £5,000. But the Committee thought that in America, where land, fences, and stone were cheaper, the cost would be less.[28]

An alternative mode of construction, which the Committee seemed tentatively to favor as "by far the most substantial and durable" was to lay continuous stone foundations under the rails, as was done on the Granite Railway after the original wood foundations rotted. The savings in cost, because of use of a lighter iron rail, would be substantial. The Committee estimated on the basis of questionnaires sent to various citizens in the western counties that split stone could be obtained at 12½ cents a foot. On this basis, the Committee estimated that a "stone" railroad would cost, in materials alone, only $5,480.62½ per mile, whereas the cost of iron alone on a double railroad of the English type would be $20,500 per mile. Iron was assumed to cost $100 per ton.[29]

The Committee had received from Thomas H. Perkins an exact account of the cost of the three-mile Granite Railway. Exclusive of the cost of "land, wharf, etc.," it came to $11,052.98 per mile, and men acquainted with the railroad were convinced that it could be done again for one-third less. This cost the Phelps Committee compared with the $17,000 to $18,000 per mile cost of the Middlesex Canal and the $20,000 per mile cost of the Erie. Evidently, if continuous stone foundations were used, the railroad would be far cheaper than the canal.[30]

THE EXPERIENCE CRITERION

Since these technical arguments for the railroad were almost identical with those used by the Pennsylvania railroad advocates and by the Sundry Citizens of Baltimore, we may conclude that in no case did purely technical considerations determine the choice of technical method. We turn, therefore, to the ground of choice emphasized in the chapters on Baltimore and Pennsylvania above, the ground of experience. The Pennsylvanians adhered to the canal method because it had been fully tested in New York; the Baltimoreans took a chance with the railroad despite the lack of experience with its general-purpose form in both Great Britain and the United States. What was the Massachusetts attitude toward experience?

The success of the Erie certainly did influence events in Massachusetts; indeed Loammi Baldwin's report in favor of a canal and Governor Lincoln's reaction to that report simply repeated the familiar Pennsylvania pattern. Even the statements of the Massachusetts railroad advocates reflected the profound influence of that dramatic example. The Citizens Committee wrote of the developmental effects of all improvements—roads, streets, bridges, canals—and its principal example was the development of the regions bordering the Erie Canal. As the Committee was not at all sure of the cost of a railroad to Albany, it cited the Erie Canal figure of $20,000 per mile, but believed it might be reduced to $15,000. The Citizens Committee wrote of the enormous revenues to be expected of a railroad to the west—but "for want of facts" on the tonnage to be expected, cited the tonnage on the Erie as its evidence. Those revenues, the Committee believed, would be sufficient, as in the case of the Erie, to extinguish the railroad debt within thirty years and would provide a surplus which could be used to build branch railroads to every part of the state. Thus, the dreams were precisely those of the canal advocates of Pennsylvania, but the vehicle was the railroad.

Emory Washburn made the most extensive use of the success of the Erie Canal to promote the railroad. He saw nothing contradictory in listing his many objections to a canal in Massachusetts, then in beginning his very next article with a paean in praise of canals and a tribute to the enterprise of Massachusetts, the state in which had been built the first such project in the country. The pioneering Middlesex Canal had no such success as the New York canals, Washburn admitted, but it was, nevertheless, of immense benefits to its region. "Such must ever be the effect of a canal upon any feasible route." If Massachusetts could build a canal between Boston and the Hudson "as cheaply, and upon as feasible a route" as that of the Erie or Champlain canals, then, Washburn declared, Berkshire's marble would no longer be too expensive on account of its transportation cost to be sent to Boston, nor would the valuable ores of Hampshire County lie worthless in the ground, and her mountain streams remain unoccupied and unimproved. ". . . from the known effects of the Erie Canal, these positions must strike every one as obviously correct."

[28] 11–15, 17.
[29] 14–19.
[30] 8–19, 29–30.

In view of these known effects, Washburn could not help but express his amazement at the recent lack of action in Massachusetts. What had happened to the spirit that had produced the Middlesex Canal? How could the state remain passive so long, then, "satisfied with an abortive attempt" at an east-west improvement, lapse back into passivity?

> What though a canal is impracticable or impolitic from Boston to the Hudson? what though our mountains are a barrier not to be passed by inland navigation, and our winters are too cold and of too long continuance to admit of its expediency if practicable? . . . The very mountains which form the barriers to our canals furnish materials for a substitute. . . . Their quarries and minerals may be easily wrought into Railways, and by these a cheaper and all things considered, a better channel of Commerce be opened from Boston to the Hudson. . . .

The benefits of such a railroad, Washburn contended, could be estimated from the benefits of the Erie Canal. New York would have an unfailing source of income from her canal after defraying all costs. A Massachusetts railroad would be as profitable in proportion to its cost, and would in addition develop "manufactures" on all the inland streams of Massachusetts and thus "a market for the products of our soil be formed on the acres upon which they *grow*." [31]

In this way the inspirational aura with which the Erie Canal had surrounded the canal was transferred bodily to railroads. There is nothing remarkable in this. The lesson of the Erie was that, under the proper conditions, transportation lines through undeveloped regions yield enormous developmental returns. It is the Pennsylvania case that appears remarkable, for the improvement leaders there drew a different lesson. All such lines must yield enormous returns, they claimed, and they therefore eliminated all criteria of choice save that of experience.

What about the lack of experience with railroads, the lack so emphasized in the Pennsylvania debate? "The art of building railroads is yet in its infancy," wrote Nathan Hale, but the experiments thus far had demonstrated that "in many situations, at least, and for many purposes" the railroad had "decided advantages" over the canal.[32] As noted above, Washburn contended that mountains were no obstacles to railroads and gave as evidence the use of English railroads in hilly country. True, they overcame steep grades by means of inclined planes and stationary engines, a method which Washburn considered expensive and inconvenient. Could this method, he asked, be avoided in mountainous regions? Here is his supremely confident answer:

> We do not believe it impossible to discover any thing which can be effected by a combination of mechanical powers, in a country that has given birth to steamboats, the cottongin, and the thousand labor saving machines which have been patented by our government.[33]

Thus past technical advance in all fields was the guarantee of the railroad's future, and the Massachusetts leaders could, therefore, accept the limited British and American experience as sufficient to justify a rejection of the canal.

Was this experience the same as that known to the Pennsylvanians in the previous year? The British experience was identical; the performance of the most advanced road there, the Stockton and Darlington, was discussed in both states. In Massachusetts, Hale frankly presented all its limitations: it was built for carrying freight from the mines and kilns to the sea, "without any particular reference to the conveyance of passengers"; and it carried its heavy loads in one direction only, and therefore could be built with a greater rate of descent than would be possible on a railroad with two-way heavy traffic.[34]

The American experience, however, differed: the Granite Railroad was built after the Pennsylvania decision. This road, Hale declared, "had rendered a very essential public service by presenting a specimen, and illustrating the practicability" of the railroad. Its success "may serve to give confidence to the calculations" of those who wished to apply the technique on a much larger scale.[35] In building the road, Gridley Bryant tried a number of innovations. The foundation for each rail was formed by laying stone in a deep trench. By digging deeply, Bryant avoided buckling of the track by the severe New England frosts and thereby eliminated an important objection to American adoption of the railroad. Granite cross-ties were placed across the trenches at eight-foot intervals. To these were attached longitudinal wooden rails plated with a flat strip of iron. In 1828, when the wooden rails decayed, they were replaced by granite. It was an old-fashioned, flat-plate, horse-operated railroad, only three miles long, with only a single grade, hauling only granite; nevertheless, it stirred up a remarkable amount of interest throughout the country. One reason for the interest, perhaps, was Bryant's ingenious equipment—the switch, the portable derrick, the turn-table, and cars whose frames were mounted upon two four-wheeled trucks and attached in such a fashion as to swivel when rounding curves. All of these subsequently passed into general use. However, Charles Francis Adams' remark that the Granite Railroad "gave the death-blow to the great Massachusetts Canal project" seems much too strong, especially when viewed against the background of the Pennsylvania debate, with

[31] November 29 and December 13, 1826.
[32] 7–8.
[33] December 13, 1826.
[34] 45. On November 17, 1825, Hale's *Advertiser* published an enthusiastic detailed description of the opening on September 25th of the Stockton and Darlington and of the performance of a locomotive on its tracks.
[35] 4–8.

its emphasis on the lack of experience with a long-range, general-purpose railroad.[36] The road undoubtedly had an important demonstration effect; Americans could see techniques in use that until then could only be read about at a distance of three thousand miles. But when the Phelps Committee declared that it had proved that the "unevenness of our country" was no obstacle to the introduction of railroads, it was drawing a totally invalid conclusion.[37] A three-mile railroad on which freight was hauled only downhill could not demonstrate the practicability of a railroad over the Berkshires.

Washburn referred to a third example: construction had begun on the nine-mile coal railroad at Mauch Chunk, Pennsylvania. As a test of the general-purpose railroad it had all the limitations of the Granite road—it was to carry one commodity downgrade. But it was to replace a turnpike, and Washburn could point to the large expected savings in transportation costs.[38] Aside from these three specific references—to the Stockton and Darlington, the Granite, and the projected Mauch Chunk Railroad—there were only general references to the plans and projects produced by the English railroad mania. This was the railroad experience which, Hale wrote, "should be a sufficient recommendation of it to the attention of the people of the state . . . where the country is extremely ill-suited to the construction of canals." It was entirely the kind of experience that the Pennsylvanians, correctly enough, had described as partial, as not sufficient to prove the practicability of the general-purpose railroad.[39]

IX. THE DELAY OF THE RAILROAD

In choosing between the railroad and the canal, the attitudes of the improvement leaders of Massachusetts were simliar to those prevalent in Baltimore and differed considerably from attitudes in Pennsylvania the year before. But, as this chapter will demonstrate, the Massachusetts leaders favored a far more primitive railroad than the one projected in Baltimore and they were far more reluctant to invest in it. Most important, perhaps, their willingness to contemplate a long postponement stands in sharp contrast with both the Pennsylvania and the Baltimore attitudes. We begin with the series of events that followed the Phelps Report of January, 1827.

THE DECISION FOR A SHORT-RANGE RAILROAD

Governor Lincoln's reaction to the Phelps Report was, to say the least, lukewarm. "We are continually called to notice new propositions for facilitating intercommunication . . . ," he remarked, perhaps with a sigh. Not infrequently, he added, "the confidence of private speculation is engaged in accomplishing these projects sooner, than the public mind becomes satisfied of their practicability." He ended on a neutral inactive note and the legislature responded in like fashion. On February 22, 1827, it authorized the creation of a "Board of Internal Improvement" to consist of three members who were to employ an engineer and examine routes for canals and railroads in general. The members of the Board were appointed, but the legislature had limited their compensation to so low a level that they did very little work. They evidently made but one report, and that in regard to a local canal.[1]

With only token action by the legislature, the center of battle shifted to the daily press. In March the *Advertiser* carried the news of Baltimore's decision for a railroad. Hale dolefully contrasted the confidence in Baltimore with the flickering spirit of the people of Boston and the legislature of Massachusetts.[2] There was indeed a good deal of scepticisim in Boston. The editor of the Boston *Courier,* Joseph T. Buckingham, remarked in June, 1827, that anyone who understood the simplest rule of arithmetic knew that a Boston-to-Albany railroad was impracticable, that it would cost "little less than the market value of the whole territory of Massachusetts," and that, if built, it would be as "useless as a railroad from Boston to the Moon."[3] But there was much pro-railroad agitation as well. Late in May of 1827, Andrew J. Allen, a Boston merchant, opened an exhibition consisting of models, pictures, plans, and books on the railway and invited visitors to sign a petition for state construction of a railroad to the west. There were 2,800 names on the petition when, together with other petitions, it was presented to the legislature in June by a delegation of citizens of Boston and its vicinity and of Berkshire County. Mayor Josiah Quincy of Boston headed the delegation.[4]

Owing to the widespread railroad agitation, some effective legislative action was finally obtained in June, 1827. Resolves were passed appropriating $10,000 and authorizing the appointment of two commissioners and an engineer to make plans, surveys, and estimates for the best route for a railroad to the Hudson. Nahum Mitchell and Samuel McKay were appointed commissioners; as Loammi Baldwin was busy with other tasks,

[36] Adams, *op. cit.* **4**: 119–120; *Advertiser,* October 9, 1826; Harlow, *Steelways,* 22–27, 32–36; Kirkland, The railroad scheme of Massachusetts, 151–152. Technically, the Granite Railway was not the first in the country. About 1796, and evidently again in 1807, a tramway (that is, simply flat-plate iron or wooden rails) was used to haul earth in the development of the Beacon Hill section of Boston, and at least four others were built between 1809 and 1825 in Pennsylvania and Virginia. But without accessory innovations, a tramway is little more than a common road. See Harlow, *Steelways,* 18.

[37] 24.

[38] November 29, 1826.

[39] 3.

[1] Adams, *op. cit.* **4**: 122; Bliss, *op. cit.,* 8–9.

[2] Reprinted in Baltimore *Patriot,* March 23, 1827.

[3] Cited in Adams, *op. cit.* **4**: 122.

[4] Harlow, *Steelways,* 42.

the job of engineer was given to his brother, James F. Baldwin.

The commissioners reported on January 29, 1828. They had sent a circular to all the towns through which the road might pass, requesting information as to the quantity of goods shipped in and out during the year, the current cost of transport, and the cost of land. On this basis, they were able to present a detailed statistical analysis of the current trade on the proposed route.

The engineer had easily secured permission from New York to survey to the Hudson. He had explored two routes, but had made accurate instrumental surveys only on part of the southern route—for twelve miles west of Boston on the way to Worcester and from the Connecticut River at West Springfield to Albany—leaving a 66-mile stretch east of Springfield unsurveyed. The route was laid out so as not to exceed a grade of 83 feet to the mile; a decision on the question of shortening the distance and saving expense by the use of inclined planes and stationary engines was deferred. Despite the fact that they looked forward to an important passenger traffic, the commissioners and engineer conducted the investigation exclusively with reference to horse-operated railways. They discussed the possibility of using locomotives, but it was their view that a locomotive could not pull as great a load upgrade as could a horse, that its usefulness disappeared at a grade of 25 to 30 feet to the mile, and that it was not as adaptable to the constant loading and unloading required by a "dense and industrious population." Charles Francis Adams, Jr., attributed their rejection of the locomotive to a desire to avoid anything that might give a visionary air to their recommendations.

As laid out by the engineer, the road between Boston and the Connecticut would have a summit 1,440 feet above the Connecticut; between the Connecticut and the Hudson, the summit would be 1,477 feet above the level of the Hudson at Albany. The report gave no cost estimate because part of the route was unsurveyed, but it estimated the average cost of English railways at $25,000 per mile and added that American railroads would cost less than half this amount because the cost of the best American canals had been less than half the cost of English canals.

Of course the commissioners dwelt on the three-year-old British railroad boom. They quoted the Edinburgh *Quarterly Review* of March, 1825, which asserted that in one month associations were formed for construction of three thousand miles of railroads at a cost of twenty million pounds sterling. They described the Liverpool and Manchester, then under construction, and the operation of the Stockton and Darlington, on which a horse pulling an enormous load scarcely appeared to make an exertion. These were the advantages of the railroad in general; there was also the special advantage of a Boston-to-Hudson railroad: it would link Massachusetts to the entire continental hinterland of the Erie Canal. Finally, there were the dangers of not building a railroad; the commissioners presented statistics indicating that the trade of five western counties of the state had already been lost to New York.[5]

The report undoubtedly had a decisive influence. Its carefully argued, unanimous recommendation of a railroad, together with its survey of a good part of the route, took the railroad issue out of the realm of the exotic. And in lending its authority to the Phelps Committee's strongly worded condemnation of a canal over the mountains, it settled the fate of the canal alternative. "The public mind," wrote Adams, "had . . . at last gotten away from one portion of the mischievous New York precedent, and it only remained for it to get rid of the other portion of it—that which had led to the belief that nothing was practicable except through the action of the government." [6]

The influence of that second portion was eliminated by the Massachusetts legislature itself, which was soon to teach the businessmen of Boston that, as far as the railroad was concerned, nothing beyond surveys was practicable through the actions of government. In March, 1828, however, action was still in the survey stage, and the legislature willingly passed an act creating a "Board of Directors of Internal Improvement" consisting of nine members chosen by both houses of the legislature. Governor Lincoln, by this time a convert to railroads, was placed on the Board, but its moving spirit was to be the editor of the *Advertiser,* Nathan Hale, who was leading the public battle for the railroad. The Board was to survey routes for railways between Boston and the Hudson River and between Boston and Providence, and was to report to the legislature the next winter as to the cost and the proper agency of construction of the roads—whether state alone, or partly state and partly individuals, or corporations. James F. Baldwin was again put in charge of the Boston-to-Hudson-River surveys. In June the New York State Legislature, over the protests of the New York City representatives, pledged its support and appointed commissioners to cooperate on the surveys.[7]

The Board's report, dated January 16, 1829, was prepared mostly by Nathan Hale. Like all the previous reports, it recommended a railroad constructed like that at Quincy: deep trenches filled with stonework, and above them heavy granite rails topped with flat iron plate. This type met American conditions better, the Board believed, than the English edge rail supported

[5] Massachusetts, Commissioners for the Survey of a Route for a Railway from Boston to the Hudson River, *Report . . .*, dated January 28, 1828, *passim*, Boston, 1828; Adams, *op. cit.*, 122–123; Harlow, *Steelways*, 44.

[6] *Op. cit.*, 123.

[7] Adams, *op. cit.* 4: 123; Bliss, *op. cit.*, 11–13; Hodge, *op. cit.*, 449.

at intervals by stone blocks, for the deep trenches prevented derangement of the rails by frost, and the continuous granite support allowed the use of a much lighter iron rail, thus substituting Massachusetts' cheap granite for expensive iron. Furthermore, the granite rail did not yield to the passing train and consequently the wheels were not continually climbing a grade; the plate rail did not wear a groove in the wheels; and the permanence of granite construction would reduce repairs. The Board thought that such a roadbed and tracks would cost about $8,217 per mile, $3,250,000 for the entire road from Boston to the Hudson.

Again the grade was kept to a maximum of 83 feet to the mile, and again the question of shortening the route by using inclined planes was deferred. Again, too, a horse railroad was recommended. Railroads in England intended to use locomotives exclusively, the Board reported, and several roads there were already using them successfully. But the cost of maintaining the locomotives in England, and the relative dearness of coal and cheapness of oats in the United States, led the Board to conclude that in America horsepower would be cheaper than steam, unless it became important to move large loads of fifty to one hundred tons at rapid speed. This was nine months before the English Rainhill Trials, which were to establish definitively the superiority of the locomotive. By using one horse in level areas and two or three horses on grades, the Board expected to move freight cars at an average of three miles per hour. Freight would move from Boston to the Hudson in four days, but passenger coaches would take only twenty-two hours.

Although the Board suggested state construction—and assured the legislature that in the long run the state would only gain from it financially—there was a hint of a change in attitude. While in England, the Board pointed out, such improvements were carried out by private companies, the magnitude of the Boston-to-Hudson project made it seem doubtful that individuals would venture their capital unless they could do so with safety. Although it would be difficult, the Board thought, "to afford an adequate security for this object without the pledge of more exclusive privileges than it would be expedient for the Legislature to grant," enterprising persons might invest if the state, in addition to granting reasonable tolls, would take one-third or two-fifths of the stock. There was no application before the legislature for the formation of such a company, but the Board recommended it and emphasized that "the assistance of the Government in some manner and to some extent . . . must be given to the work." [8]

In his January, 1829, message, Governor Lincoln added to the arguments for immediate legislative action. He pointed out that in the first few weeks of "impeded and experimental" navigation on the Blackstone Canal between Providence and Worcester nearly 400 tons of freight were delivered at its head, double the quantity discharged at various points on the canal. The Governor estimated that the canal made it possible to carry goods from New York to fifty miles within Massachusetts at half the cost of land carriage from Boston to Worcester. Even timber from Maine was coming by sea to Providence and thence up the canal to the interior of the state. Something had to be done, and done quickly to save Boston's trade. The Governor suggested the possibility of a private corporation aided by the state.

But the legislators avoided action during 1829. For the trend toward private construction aided by the state aroused the most contradictory feelings among the state's Democrats. If the project were so advantageous, asked a writer in the Haverhill *Essex Gazette* in December, 1829, why did not capitalists build it themselves? And then, without pause, he raised the specter of monopoly and sky-high rates and asserted his belief that if the state undertook the construction, the income from the railroad would repay the entire cost within twenty years.[9] In February, 1829, resolutions were introduced in both houses declaring the expediency of state financial aid to the proposed railroads, but they suggested a postponement of the decision until the summer session. In the meantime, the annual state election would indicate the direction of public sentiment. As a result, the legislature was no nearer to a decision when it commenced its June session and heard Governor Lincoln again urge the necessity of immediate action. The railroad party, confronted with widespread public opposition to state construction, sponsored legislation in which the state would contribute one-third of the capital, individuals the remainder; and a House committee introduced two charters for railroads, one to the Hudson and the other to Providence. But the stipulations attached to the state subscription were unattractive to investors and nothing came of it. Then in January, 1830, after a long and acrimonious debate, the House rejected a railroad aid bill by 130 votes, and the businessmen of Boston were thus encouraged to rid themselves of the second portion of that mischievous New York precedent. Dependence on government action had got them nowhere.[10]

This legislative session, therefore, marked a turning

[8] Massachusetts, Board of Directors of Internal Improvements, *Report . . . on the practicability and expediency of a rail-road from Boston to the Hudson River and from Boston to Providence, passim,* Boston, Press of the Boston *Daily Advertiser,* 1829; Kirkland, Railroad scheme, 158; Bliss, *op. cit.,* 13–17; Vose, George L., Notes relating to the early history of transportation in Massachusetts, *Jour. Assoc. Engineering Societies* **4**: 67–71, November, 1884.

[9] Cited in Harlow, *Steelways,* 65.

[10] See Harlow, *Steelways,* 56, 65–68; Kirkland, Railroad scheme, 159–160; Kirkland, Edward Chase, *Men, cities, and transportation: a study of New England history, 1820–1900* **1**: 110–111, Cambridge, Harvard Univ. Press, 1948.

point in the early history of Massachusetts' railways. For the realization that state aid would be unobtainable, at least for some time, coincided with a series of railroad developments culminating in the Rainhill Trials and the successful operation of the Liverpool and Manchester which finally proved that public railroads, at least under certain conditions, could be profitable. For these reasons, private capital was willing to proceed, not with a Boston-to-Albany railroad—this was still considered too costly and difficult—but with a railroad to Worcester. There were good reasons to expect a profit. The distance to Worcester was but one-quarter of the distance to the Hudson, it was heavily traveled, and the existing trade was already enormous. Furthermore, investors could hope that successful operation might induce the state to construct the more difficult and costly extension to Albany. In any case, a railroad to Worcester would at least nullify, to a large extent, the effects of the Blackstone Canal, which was diverting so much of the trade of interior Massachusetts to Providence and New York City.[11]

But there was one more obstacle in the way of a Boston and Worcester charter. Despite all the factors favoring private construction, the investors demanded a guarantee of exclusive privileges. For the 1829 Massachusetts judicial decision in the famous case of the Charles River bridge was still fresh in their minds. The charter for the original bridge had been held not to be exclusive; consequently a new bridge had been built parallel to the old one and destroying its value. Hence Massachusetts' capitalists were even more timid than usual, and their timidity was increased by the memory of certain unfortunate turnpike and canal experiences. A legislative stalemate resulted. Individuals would not invest without a franchise guaranteeing exclusive railroad rights between the terminals, and the legislature would grant no such monopoly. The legislature finally surrendered in June, 1830, when it granted a charter to the Boston and Lowell which conceded exclusive privileges for a thirty-year period.[12]

During the January, 1831, session, private investors made one last attempt at obtaining government aid. They offered to subscribe two-thirds of the capital of a railroad to Worcester, while the Boston City Council petitioned for permission to subscribe up to a million dollars to a western railroad. The legislature did nothing about the first proposal and vetoed the second. Hence, in June, 1831, an act of incorporation granting a thirty-year monopoly but no financial aid was obtained for the Boston and Worcester (and for the Boston-to-Providence railroad as well). There was little opposition to the charter; the legislature felt relieved of a troublesome subject.

The decision to build the Boston and Worcester contrasts with the projection of the Baltimore and Ohio Railroad not only in timing and in the scale of the project, but also in the kind of railroad envisaged. In Pennsylvania, canal advocates such as Mathew Carey had insisted that the railroad would require at least four pairs of tracks, and railroad advocates believed two pairs to be a necessity. In Baltimore, the merchants projected a double railroad. But in Massachusetts, the necessity of a second pair of tracks was the subject of a long debate among the railroad's proponents. The Phelps Committee called for a double railroad, but Nathan Hale thought it unnecessary, "at least until the experiment of a single one is tried," and hoped that sidings would be sufficient for passing. More than two years later, in the spring of 1829, the long and intensively conducted debate was settled in favor of a double pair of tracks for the Boston and Worcester, but later the Western Railroad was built with but a single pair.[13]

Then there was the problem of the locomotive. On this question Massachusetts stood alone. In Pennsylvania, Strickland had pointed out that the railroad's crucial advantage over the canal lay in its speed, and that the speed depended on the use of the locomotive. This was the view of the British authorities on the subject, though the Pennsylvania railroad advocate who wrote *Facts and Arguments* was for postponing a decision on the issue. In Baltimore, the Sundry Citizens proposed a locomotive railroad and started construction of a road that could use either horse or locomotive. In Massachusetts, however, all the railroad advocates and all the official reports called for an exclusively horse-operated railroad. Hale recognized that the railroad was more efficient than the canal only at speeds above approximately three miles per hour. He also recognized the importance of speed for certain types of freight and for passengers. But while praising the locomotive, he refused to depend on it. It was sufficient, he declared, that a horse could move at its top speed without effort when on a railroad. The railroad would, therefore, attract passenger traffic, for the cars would move as rapidly as the speediest stage coaches, at least on levels. Since canals were "utterly unfit" for passenger conveyance, this doubled the relative utility of the railroad.[14] For two years Hale main-

[11] Harlow, *Steelways*, 77–78; Kirkland, *Men, cities, and transportation* 1: 114; Hodge, *op. cit.*, 450; Adams, *op. cit.* 4: 126. The Massachusetts investor was here distinguishing between what H. Jerome Cranmer has termed the "exploitative" and the "developmental" project. The former takes advantage of an existing profit opportunity; the latter is considered worthwhile because it provides transportation facilities to an otherwise isolated region and may thereby stimulate the economic life of the region. Contemporary writers made the distinction, Cranmer points out, and justified government aid for the latter type. See his: The New Jersey canals: a study of the role of government in economic development, 298–299, unpublished dissertation, Columbia Univ., 1955.

[12] Adams, *op. cit.* 4: 125–126; Kirkland, *Men, cities, and transportation* 1: 116–119.

[13] See Hale, 16, 40; Harlow, *Steelways*, 57–61.

[14] 13, 51–52.

tained the opinion that the locomotive "would have no advantage over horse power" where the cost of fuel exceeded the cost of maintaining horses for the same amount of power. For freight, he contended, "a rapid rate of traveling is not, in general, of any great advantage." [15] But Hale was no dogmatic; it was just that, unlike the Baltimoreans, he required proof by experience. Late in 1829 the Rainhill Trials converted him into a locomotive enthusiast.[16]

Thus, at the time they rejected the canal in favor of the railroad, the Massachusetts improvement leaders envisaged a much simpler and cheaper kind of railway than did their colleagues in the other areas. The Phelps Committee defined a railroad as simply a carriage road equipped with tracks, and the Massachusetts railroad advocates tried to cleave as closely to that definition as possible. In so doing, they had to ignore considerations that had been clearly raised in the Pennsylvania debate: the difficulties of passing on a single set of tracks and the questionable advantages of the horse railroad over the canal. Their belief that they could build a railroad with a much lighter iron rail than was considered necessary in England by providing it with a continuous granite foundation also falls into this category, as does their reluctance to accept the method of inclined planes and stationary engines. They were for the most conservative, least risky kind of railroad possible, and that caution evidently led them to ignore some well-known facts. In addition to caution, there were the political considerations flowing from the dependence upon state construction that we have met with in Pennsylvania. As the railroad commissioners' report of January, 1828, put it, they had considered inclined planes using mechanical power, "but . . . it is thought best to proceed on the most simple system, and that which in practice will be found to comport with the common habits and opinions of the people." [17]

The conservatism of the Massachusetts leaders might easily have led them into some extremely expensive errors. If they had immediately built the railroad they had in mind in the 1826–1829 period, they would have spent large sums on a rigid continuous granite foundation that would have wrecked their light rails and their cars as well—not to speak of their passengers; and within a few years they would have been forced to adapt their road for locomotive use. But their caution served them well. In the choice between railroad and canal, the simpler the railroad the less the resistance to it. Then, in refusing to proceed on their own for some time, the businessmen of Massachusetts avoided the errors of their Baltimore colleagues. In both decisions, there was none of that carefree enthusiasm that led the merchants of Baltimore to take great and sometimes needless risks.

The Boston and Worcester Railroad Company was organized on May 1, 1832. By the time it began construction in August, opinion was swinging to the use of a wooden substructure. It swung too late for the Boston and Lowell, but that railroad used heavy-edge rails as well; it favored the granite structure, not for reasons of economy, but for permanence. On the Boston and Worcester and the Boston and Providence there was a greater spur to economy for each was nearly twice as long as the Boston and Lowell. Furthermore, their chief engineers had been trained on the Baltimore and Ohio, and a Boston and Worcester report of February, 1834, refers to "experiments made on Railroads in the Middle States" which had proved the undesirability of stone. In addition, the Boston and Providence's chief engineer was sent abroad to examine the Liverpool and Manchester, where he observed the advantages of a wood structure. Consequently, the rails on the completed Boston and Worcester rested on cedar cross-ties; and instead of trench walls, a prism of rubble and broken stone was laid in a trench beneath each rail. The result was an elastic roadbed much easier on rails, cars, and passengers, and much less expensive. Construction of the Boston and Worcester was superior too in its avoidance of inclined planes. Sharp curves were introduced, not only to keep the maximum gradient to thirty feet to the mile, but also to minimize deep cutting wherever possible.[18] From the beginning the tracks were built to accommodate locomotives. The line was completed in July, 1835, at a total cost of $1,319,000. Receipts in the first two years of operation made it a financial success.[19]

THE DECISION FOR AN INTERREGIONAL RAILROAD

The process of extension of the Boston and Worcester to Albany was begun in March, 1833, when the legislature granted a charter for the Western Railroad Corporation. The incorporators were the directors of the Boston and Worcester, and the shareholders of the latter road were given preference in purchasing the stock of the Western in case the subscription exceeded the $2 million maximum capitalization set by the act. Shortly thereafter, the New York legislature incorporated a company to construct the section from the New York State line to the Hudson.

Then came a long delay. For one thing, construction experience on the Boston and Worcester soon demonstrated that the Western's $2 million capitalization would be entirely inadequate. The Boston and Worcester's forty-three miles, one-third of the distance to the

[15] Hale, Nathan, Massachusetts railroad, *North Amer. Review* **28**: 526, 1829.

[16] See Harlow, *Steelways*, 61–62.

[17] 23–24.

[18] Kirkland, The railroad scheme, 167–169; Harlow, *Steelways*, 94–95; Adams, *op. cit.* **4**: 129, fn. 2.

[19] Hodge, *op. cit.*, 450–451; Adams, *op. cit.* **4**: 126–127.

New York State line, was obviously going to cost over $1 million, and it did not have the Berkshires to cross. Furthermore, many were still doubtful of the advantages of a railroad in a mountainous area in view of the inability of the locomotive to surmount steep grades.[20] As a result, no serious effort to sell the shares was made before the Boston and Worcester was completed. Then, when the books were opened for a ten-day period in August, 1835, only 13,000 of the 20,000 hundred-dollar shares were sold. Charles Francis Adams considered the public's lack of confidence to be "somewhat inexplicable." The $2 million outlay was not a heavy one—Boston alone had a population of 80,000 and an assessed valuation amounting to $80 million. Furthermore, a mania for railroads was sweeping both England and America, and all three of Boston's internal lines—to Lowell, to Providence, and to Worcester—were financially successful.[21]

The directors of the Western had to resort to an intense propaganda drive to sell the shares. A mass meeting was held in Boston and a committee of solicitation was formed for each of Boston's wards and for every major city to sell shares to everyone "from the capitalist to the carman." But the going was heavy. According to the historian of the Western Railroad,

> There was a universal belief that the stock would never be productive, and the most sanguine friends of the enterprise could only urge the argument, that the incidental advantages of opening this great thoroughfare, ought to induce the whole population . . . to subscribe according to their ability, even if the subscriptions themselves proved a dead loss.[22]

But not everyone agreed as to the proper goals of public policy. "Some think the city is large enough and do not want to increase it," wrote Josiah Quincy, Jr. in his diary after a hard day of stock selling.[23]

The subscription was finally met in December, 1835. Bostonians constituted three-fifths of the more than 2,200 subscribers and subscribed more than three-quarters of the stock. Many of the subscriptions were taken in the name of firms, indicating the extent to which the undertaking was considered an aid to the city's business rather than a money-making enterprise. The largest subscription was for only 200 shares, "and names always associated in Boston with the idea of great wealth are found in this list set down opposite to amounts representing a risk, in what has since proved one of the most reliable of investments, of five hundred or a thousand dollars." According to Adams, it was the general expectation, shared by the directors, that after one unsuccessful effort all idea of building the railroad as a private enterprise would be abandoned, and the work would be taken up by the state.[24]

The corporation applied for a state subsidy as soon as it was organized in January, 1836, and managed to get it. But it was only by means of an ingenious maneuver that state aid for a trans-Appalachian railroad was finally achieved in Massachusetts. The company's petition asserted that its experience since the charter was granted indicated that the railroad would require $1 million more than its $2-million capitalization. However, the company asked for no grant from the Treasury, only for permission to incorporate a "Western Railroad Bank" with a capital of $5 million. The bank was particularly needed at the time, the petition alleged, because of the non-renewal of the charter of the Bank of the United States. At the same time, another petition, signed by 1,736 individuals, prayed for establishment of a bank with a capital of $10 million. Hence, in March, 1836, an act was reported in the House for establishment of a "State Bank of Massachusetts" with a capital of $10 million, the directors of which would be required to purchase $1 million of the shares of the Western Railroad Corporation. Democrats opposed to "monster banks" perceived that the combination of railroad and pro-bank interests could carry the bank bill and therefore swung to support of direct subsidy to the Western Railroad. Consequently, a $1-million state subscription to the railroad passed overwhelmingly and the bank bill was indefinitely postponed.[25]

In the winter of 1836–1837 the company's engineers started the first detailed survey of the route. Their report, which came just after the panic of 1837, informed the directors that the road would cost, not $3 million, but $4 million. The directors turned again to the state legislature, this time for a loan in scrip of $2,400,000, the scrip to be sold in the English market, which was not yet shaken by the revulsion against American securities. Another state-wide agitational campaign ensued, and in February, 1838, the state loaned $2,100,000 of its securities to the Western. In 1839 and 1841 the state gave further loans amounting to $1,900,000. The Western reached the Connecticut River at Springfield in October, 1839, the Hudson at Albany at the close of 1841. The single-tracked road was pronounced finished early in the following year. The total cost of the two railroads between Boston and Albany came to almost $9 million.

In view of the scepticism of the investors, it is interesting to note that the Western Railroad became "one of the most productive works in the United States," paying an annual dividend of eight per cent besides

[20] Bliss, *op. cit.*, 21–22. Kirkland, *Men, cities, and transportation* 1: 125–127.

[21] Adams, *op. cit.* 4: 131. *Cf.*, however, Harlow, *Steelways*, 117. Harlow attributes the lack of confidence to the general feeling of insecurity caused by Jackson's battle with the Bank of the United States.

[22] Bliss, *op. cit.*, 28.

[23] Cited in Kirkland, *Men, cities, and transportation* 1: 127.

[24] Adams, *op. cit.* 4: 131–132; Kirkland, *Men, cities, and transportation, op. cit.* 1: 129. On the scepticism among the Western's Board of Directors, see also Bliss, *op. cit.*, 148.

[25] Bliss, *op. cit.*, 31–33.

accumulating a large sinking fund. The road became, according to the Andrews Report, "the chief instrument of the extraordinary progress of Massachusetts in population, wealth, and greatness from 1840 to 1850." In 1867 the Boston and Worcester and the Western Railroad combined to form the Boston and Albany.[26]

THE WILLINGNESS TO POSTPONE: SUMMARY AND CONCLUSIONS

The most striking aspect of these events, when compared to the corresponding events in Pennsylvania and Baltimore, is the delay of construction, a delay that reflected not only the attitudes of the legislature and of the average Boston businessmen but of the improvement leaders as well. Nathan Hale was far more cautious than either Mathew Carey or the Sundry Citizens of Baltimore. In June, 1827, he was recommending to the legislature a railroad only to the Connecticut River. Its extension to the Hudson, he admitted, would greatly increase its value, but its advisability "will be much easier to judge, after further experiment shall have been made." Experiment was needed, he thought, to determine the expense of necessary apparatus for passing long and steep hills and the delay to transportation that the apparatus would cause. He was evidently thinking of the inclined-plane method. For the moment, Hale wrote, he would pass over such topics, leaving them for future consideration after the railroad to the Connecticut had been built and its success determined.[27]

In the same month the Phelps Committee recommended a railroad to the Hudson, but, for the moment, it asked only for surveys. And two years later Hale was still not calling for immediate state construction to Albany. He agreed with the legislature when it postponed action on the January, 1829, commissioners report for a railroad to the Hudson because "the magnitude and novelty of the undertaking, afforded strong reasons for deferring a final decision. . . ." [28] It was only in late 1829 that railroad advocates began to press for immediate state construction to the Hudson. But, as the above account of the difficulties of the Western Railroad has indicated, the Massachusetts investor was even more cautious.

Why the willingness to delay? For the period up to 1830, the explanation seems clear. In a perceptive article on the canal and railroad enterprise of Boston, Charles Francis Adams, Jr., attributed the delay to a widespread bias in favor of canals and against private enterprise in transportation. That bias, though it was greatly strengthened by the example of the Erie Canal, had taken root in the Boston community as a result of its own experience, Adams believed. Back in the 1790's, improvements in the channel of the Merrimac River had threatened to make Portsmouth the point of distribution for the trade of the whole interior of New Hampshire. Private enterprise reacted boldly to this first threat to Boston's hinterland trade by constructing the 27-mile Middlesex canal, the first such canal in the country. Together with the improvements of the Merrimac that were necessarily involved, the project cost about $500,000, an enormous sum for that period. Begun in 1794 and completed in 1803, it succeeded admirably in its purpose. For three decades it brought to Boston the produce of the region tributary to the upper Merrimac. But the region was small, rather poor, and not very populous; consequently, the canal was a financial failure. This was Boston's sole practical experience with canals.[29]

By 1825, therefore, there were two striking examples of the effects of canal construction before the eyes of the Boston investor: the financial failure—despite public gain—of private enterprise in the Middlesex Canal, and the great success of public enterprise in the Erie Canal. State construction of the line to the west was, therefore, considered a necessity. But the legislature—fortunately, according to Adams—stubbornly refused to act, and an impasse developed. The January, 1828, report of the railroad commissioners showed the businessmen of Boston the way out of that impasse when it referred to the projects of private railroad companies in England. "The time had not yet come, however, when, recurring to sound principles, these [businessmen] were to try to stop educating farmers, and put their hands in their pockets, and their shoulders to the wheel." The influence of those canal examples and the impasse they had brought about was finally broken late in 1829, when the Rainhill Trials and the performance there of George Stephenson's "Rocket,"

> . . . signalled to the world the advent of a new era. . . . The results were immediate. All the slow educational work of the six preceding years seemed to bear fruit in a day,—not in the Legislature, but in the marketplace. Individual enterprise came to the front, and when the Legislature met in January 1830, petitions for the incorporation of private railroad companies were presented to it.[30]

However, comparative analysis produces a somewhat different view. All of the rivals of New York were profoundly influenced by the Erie Canal's success and were somewhat influenced by the financial failure of various privately constructed local canals and roads. But while Pennsylvania held to the canal, Baltimore and Massachusetts rejected it; and while Pennsylvania and Massachusetts tried to depend upon state enterprise, the merchants of Baltimore "put their shoulders to the wheel." If the influence of the Erie varied so

[26] Andrews Report, *op. cit.*, 248–249. See also Kirkland, *Men, cities, and transportation* 1: 131–134.
[27] 33–34.
[28] "Massachusetts railroad," 523.
[29] Adams, *op. cit.* 4: 111–113.
[30] *Ibid.*, 121–123, 126.

widely, it cannot by itself explain the Massachusetts postponement. Furthermore, the reluctance of Boston's businessmen to "put their hands in their pockets" before the Rainhill Trials is more understandable than Adams implied. On the contrary, it is the daring of the businessmen of Baltimore in proceeding with a railroad over a mountain range before the general-purpose railroad was proven that is difficult to understand.

But the delays of the 1830's are another matter. That six years after the opening of the Liverpool and Manchester, the Massachusetts businessman could not be convinced of the safety of private investment in the Western Railroad is an indication of a conservatism that goes beyond the bounds of ordinary caution. However, for the purposes of this comparative analysis, it is only necessary to state that the behavior of the Massachusetts businessman was clearly more cautious than that of his Baltimore and Pennsylvania contemporaries. The relevant facts are that the Pennsylvanians proceeded immediately with construction of a line competitive with the Erie; that on the basis of railroad experience up to 1827 the merchants of Baltimore were willing to launch a double-tracked, locomotive-powered railroad all the way to the Ohio River; that, on the other hand, on the basis of the much greater railroad experience up to 1831, the merchants of Massachusetts reluctantly decided to proceed with private construction of an extremely simple and primitive railroad only to Worcester; and that in 1836 they were still sceptical of the success of the kind of venture that the Baltimore group had launched so optimistically nine years before.

How can we explain the fact that Massachusetts could calmly delay its trans-Appalachian line for a decade? In the Baltimore and Pennsylvania cases, the decision for immediate construction was attributed in part to a panic reaction to the competitive situation. In both cases, and particularly in the case of Baltimore, there was evidently good reason for concern, though not of course for panic. Did Massachusetts have as good reason for a desperate sense of urgency? If it did not, then the situation helps to explain the more conservative behavior there.

In one important aspect, however, the transportation problem of Boston was more difficult and dangerous than that of either Philadelphia or Baltimore. All three cities were confronted with two geographic factors that made a navigable communication with the west extremely difficult: the mountain barrier and the fact that the principal eastern rivers run north and south. But if they could not easily reach the west, Philadelphia and Baltimore could at least extend their local hinterland by means of improvement or canalization of those eastern rivers. Baltimore could drain the trade of central Pennsylvania by means of the Susquehanna; Philadelphia could exploit a wide area along the Delaware. But the improvement and canalization of the rivers of Massachusetts threatened to destroy Boston's local hinterland. If Philadelphia and Baltimore were made desperate by an inability to expand to the west, what should have been the reaction of a city that not only could not expand but whose local trade was in danger of destruction?

As Emery Washburn and Nathan Hale pointed out in their articles at the end of 1826, all of Massachusetts' major interior waterways—the natural courses for canals—crossed the paths of Boston's hinterland trade, and various ports were taking advantage of this to draw Boston's trade to their own markets and thence to New York City. They cited the improvement of the navigation of the Connecticut River and the projected canal from Northampton to New Haven, both of which would draw the trade of the Connecticut valley through New Haven to New York; and further east, there was the "dark line of the Blackstone Canal," which would soon draw the trade of Worcester County through Providence also to New York's door. Hence, when Washburn and Hale rejected the canal, they immediately added that an east-west transportation line was an absolute necessity; that the very existence of Boston depended on it.[31]

This was the danger to Boston's local hinterland; there was also the danger to her traditional long-range commerce. If New York achieved a near-monopoly of the western trade, she would also achieve a near-monopoly of the foreign trade. British freight would have little reason to go to Boston, every reason to go to New York. The situation, therefore, was at least as urgent for Boston as for the other rivals of New York, and it so appeared to the Massachusetts leaders. In 1829 Hale's Boston *Advertiser* complained that an estimated 100,000 persons had emigrated from Massachusetts in a decade.[32] The figure was probably exaggerated, and there was emigration from other New England states as well, but the important thing here was not the fact but the belief. There was a fear of stagnation in Massachusetts that was at least as palpable as in Pennsylvania and Baltimore:

> Between the close of 1825 and the beginning of 1831 gloom and despondency seemed to settle down upon Massachusetts. Her sons left her to build up rival states and cities, and her fairest and richest daughters were courted away to grace more prosperous lands. The grass began to invade the wharves and pavements of her commercial centers and the paint to desert the front of her villages. . . . She seemed to stand at the ancestral tomb, sorrowing that she could not partake of the progress of the age. . . .[33]

Nevertheless, Massachusetts leaders showed little haste for construction. For three years after the rejection of the canal, Hale called for the railroad to the

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[31] Washburn, November 22, 1826; Hale, 57–58. See also, Kirkland, The railroad scheme, 146–147.

[32] See Harlow, *Steelways*, 9.

[33] Derby, Elias H., Progress of railroads in Massachusetts, *The Merchants' Magazine and Commercial Review* **14**: 30, 1846, quoted in Kirkland, The railroad scheme, 149.

Connecticut that would at least solve Boston's intrastate problems, but he accepted postponement of the trans-Appalachian railroad in the interests of caution and careful investigation. For a decade after the rejection of the canal, the Massachusetts investor hesitated. The contrast with Baltimore could not have been more extreme.

In 1837, at the beginning of construction of the Western Railroad, Nathan Hale wrote a most perceptive analysis of the position of New York's rivals in the previous decade. Perhaps in reaction to the delays of the 1830's, he tried to demonstrate that in these large-scale transportation projects the consequence of delay was disaster. In the competition between cities, he asserted, once a transportation line is built and the ground occupied, it quickly becomes extremely difficult to change the direction of the established channel of trade or to introduce a substitute for it.

> For this reason, a much greater degree of eagerness in the pressing of works of this description is excusable, in situations in which the immediate prospects of business seem hardly to justify it, than would otherwise be thought judicious. . . . Cities continue to grow, not because their situation is intrinsically the most advantageous, but because they have already acquired a certain growth, which of itself contains within it the elements of further increase.

His example, of course, was New York. A decade before, the city had acquired such advantages—in inland navigation, in coastwise and transatlantic steam packets, in the wealth and enterprise of her citizens—that she seemed destined to obtain "at no remote period" a monopoly of the foreign trade of the country.

> The towns of a secondary class, Philadelphia, Baltimore, Boston, and Charleston, were approaching daily the condition of provincial towns, dependent for all the principal operations of commerce on the port of New York. A great part of the domestic trade of Massachusetts had by degrees formed a direct connection with that city. Canals were dug leading in that direction, from the counties of Hampden and Hampshire, and even from Worcester, the very centre of the State. Boston, the metropolis formerly of New England, had almost ceased to be the commercial metropolis of her own State.

Then the public railroad was introduced in England and became known in the United States. It was evident, "from the first proofs of their efficacy" that they were capable of transforming the situation;

> that the currents of traffic and of personal intercourse, instead of passing only through channels where water could be made to flow, might be led across mountains, and through every region . . . that the prosperity of cities, instead of depending on the accident of being placed on a navigable stream which can float its commerce to a vast interior, would hereafter depend upon the foresight and energy of their inhabitants. . . .

It was these circumstances, Hale concluded, that accounted for the "earnestness" of the early railroad advocates and for the "eagerness" of the public; and for the fact that, among the many judicious projects, there were also many which were likely to disappoint the expectations of their projectors, and still more which were impracticable and visionary.[34]

Thus, at the end we return to the theme of the introductory quotation from Lucien Febvre: neither the earth, nor the influence of climate, nor the conditions of localities alone determine the outcome of events. As Charles Francis Adams, Jr., put it in his bitter article on the Boston of the late fifties, it is true that capital flows where it is needed; that there is a tendency for railroads, steamboats, and factories to appear when and where the lack of them is felt; "Nevertheless, channels of trade are not wholly naturally channels; they admit of a sort of pre-emption right."[35] It was not nature, Adams insisted, that designated New York as the commercial and railroad center of America; it was New York's interference with nature. Local energy and enterprise were the decisive factors, Adams concluded, and he cited Buckle: "it is only in Asia and semi-barbarous countries that the course and extent of trade are regulated by the original features of the country, but in Europe and among advanced nations its determining cause is the skill and energy of men." And perhaps we may add that as the advance of modern technology increases the freedom from objective necessity, the understanding of the historical process depends as much upon the analysis of the subjective traits of groups as it does upon the analysis of the pressure of objective circumstances. It is this fact that emerges most clearly from this limited comparative study of Philadelphia, Baltimore, and Boston in the second quarter of the nineteenth century.

[34] Hale, Nathan, Poussin on American railroads, *North Amer. Review* **44**: 438–439, 1837.

[35] Boston, *North Amer. Review* **106**: 1–25, January, 1868.

APPENDIX

SUMMARY DESCRIPTION OF THE TRANS-APPALACHIAN PROJECTS

	Terminals	Construction Dates	Length (miles)	Canal Prisms (feet)	Total Rise and Fall (feet)	No. of Locks	Original Cost[10] (or Estimated Cost)
New York							
Erie Canal[1]	Albany Buffalo	July 1817 Oct. 1825	363	40 × 28 × 4	675–689	83–84	$7,143,790
Pennsylvania							
Mainline-estimated[2]	Phila. Pitts.	—	395	40 × 24 × 4	3,336	417	$3,000,000 (estimate) plus cost of canal from Phila. to the Susquehanna River
Mainline[3]	Phila. Pitts.	July 1826 Mar. 1834	395	40 × 28 × 4	5,617	174	$12,106,788
Pennsylvania RR[4]	Phila. Pitts.	July 1847 Dec. 1852	354	—	6,342	—	$17,439,485
Potomac Area							
Chesapeake & Ohio Canal-estimated[5]	Georgetown Pitts.	—	342	48 × 33 × 5	3,158	398	$22,375,428 (estimate)
Chesapeake & Ohio Canal[6]	Georgetown Cumberland	July 1828 Oct. 1850	185	50–60×30–42 × 6	610	74	$10,113,938
Baltimore & Ohio RR[7]	Baltimore Wheeling	July 1828 Jan. 1853	379	—	9,460	—	$16,779,451
Massachusetts							
Boston to Albany Canal-estimated[8]	Boston Albany	—	178	43 × 28 × 5	3,281	410	$ 6,000,000 (estimate)
Boston to Albany Railroad[9]	Boston Albany	Aug. 1832 Sept. 1842	201	—	5,108	—	$ 8,885,792

[1] Whitford, Noble E., *History of the canal system of the State of New York . . .*, supplement to the *Annual report* of the state engineer and surveyor of the State of New York for 1904/05, **2**: 1030, Albany, Brandow Printing Co., 1906. According to Whitford, the early records of the Erie as originally constructed give two figures for the total rise and fall and for the number of locks. The engineers' cost estimate for the Erie was $4,881,738.

[2] The estimates are those in the February, 1825, report of the majority of the Pennsylvania Canal Commissioners. The Commissioners called for an unbroken canal from Middletown on the Susquehanna to Pittsburgh, to be achieved by means of a four-mile tunnel under the summit of the Alleghenies. While they suggested temporary use of the Union Canal in the area between Philadelphia and the Susquehanna, they called for ultimate state construction of a larger, more direct canal in this area but did not estimate its cost. They did, however, estimate its length at 125 miles and its lockage at 741 feet, and these estimates have been included in the figures in the table. The report called for locks with a lift of eight feet each, hence to obtain the figure for number of locks, I divided the total rise and fall by eight. See Pennsylvania Board of Commissioners for . . . Internal Improvement, *Report*, in Pennsylvania House of Representatives, *Journal* 1824/25, **2**.

[3] Bishop, Avard L., The state works of Pennsylvania, *Trans. Conn. Acad. Arts and Sciences* **13**: 199, 280, 1907; Tanner, H. S., *A description of the canals and railroads of the United States*, 97, New York, Tanner and Disturnell, 1840; Dorsey, Edward Bates, *English and American railroads compared*, maps facing 140, 2d ed., New York, Wiley and Sons, 1887. The figure for total rise and fall was obtained by taking Tanner's figure for the total rise and fall from the Susquehanna River to Pittsburgh (3,711.82 feet) and adding to it an approximate figure for the total rise and fall on the Philadelphia-Columbia Railroad (1,905 feet) as calculated from the large profile map in Dorsey. The mainline required only 174 locks because it was not the full canal called for in the February 1825 report of the Pennsylvania Canal Commissioners (see footnote 2).

[4] The figures for length and total rise and fall are approximate figures calculated from the profile map in Dorsey, *op. cit.* The cost figure is that for the Pennsylvania Railroad in December, 1852, when it was still using the old Allegheny Portage Railroad of the Pennsylvania mainline. It is the sum of the costs of the Pennsylvania Railroad from Harrisburg to Pittsburgh, the Allegheny Portage Railroad, and the Philadephia-Columbia Railroad. See Pennsylvania Railroad Company, *Sixth annual report of the directors . . . to the stockholders*, 41, Philadelphia, 1853; and Bishop, *op. cit.*, 278.

[5] U. S. House, Board of Internal Improvement, *Report . . . of the board of engineers for internal improvement, concerning the proposed Chesapeake and Ohio Canal*, submitted December 6, 1826, 37–62, 19th Congress, 2nd Session, House Document no. 10. The Board's estimate of the cost of the Cumberland-to-Georgetown section was $8,177,081. The report called for a five-mile tunnel under the summit but raised the possibility of a portage railroad. This was the official cost estimate at the time of the decision for the Baltimore and Ohio Railroad. The estimate was later reduced by a new United States Board.

[6] U. S. Census Office, Tenth Census, *Census reports* **4**: 16, *Report of the agencies of transportation in the United States*, Washington, 1883.

[7] Baltimore and Ohio Railroad Company, *27th annual report of the president and directors to the stockholders . . .*, 11, Baltimore, 1853; Poor, Henry Varnum, *History of the railroads and canals of the United States . . .* **1**, New York, John H. Schultz, 1860. The figure for total rise and fall is an approximate figure calculated from the profile map in Dorsey, *op. cit.* The projectors of the railroad estimated it would cost $5,000,000. See *Proceedings of the Sundry Citizens of Baltimore*, 33–37, Baltimore, 1827.

[8] Massachusetts Commissioners, *Report . . . on the routes of canals from Boston Harbor to Connecticut and Hudson Rivers*, Boston, 1826. The report called for locks with a lift of eight feet each, hence to obtain the figure for number of locks, I divided the total rise and fall by eight.

[9] Bliss, George, *Historical memoir of the Western Railroad*, 72, Springfield, Mass., Samuel Bowles, 1863; Kirkland, Edward Chase, *Men, cities, and transportation: a study of New England history, 1820–1900* **1**: 116–119, Cambridge, Harvard Univ. Press, 1948. The figure for total rise and fall is an approximate one, calculated from the profile map in Dorsey, *op. cit.*

[10] The original cost figures are not entirely comparable because they include, to varying degrees, the cost of equipment and second tracks.

BIBLIOGRAPHY

Official Reports

Baltimore and Ohio Railroad Company. Baltimore, 1828. First annual report of the board of engineers. *Second Annual Report of the President.*

—— Baltimore, 1827 and 1828. First and second annual reports of the president.

—— June 23, 1827. Report of the committee appointed by the Baltimore and Ohio railroad company to examine the Mauch Chunk and Quincy rail roads (dated June 12, 1827). *Niles' Weekly Register* **32**: 282–284.

—— Baltimore, 1853. *27th Annual Report of the President and Directors to the Stockholders. . . .*

Baltimore-Susquehanna Canal Committee. January 8, 1827. Report, dated January 6, 1827, signed P. E. Thomas, chairman. Baltimore *American.*

GALLATIN, ALBERT. Washington, 1808. *Report of the Secretary of the Treasury on . . . Public Roads and Canals . . . submitted to the Senate April 4, 1808.*

Maryland. Board of Public Works. February 9, 1827. Report . . . to the general assembly, January, 1827. Baltimore *American.*

—— Commissioners. Baltimore, 1823. *Report of the Commissioners appointed to examine into the practicability of a canal from Baltimore to the Potomac together with the engineer's report.*

—— Governor. January 3, 1827. Annual message, December 27, 1826. Baltimore *American.*

—— Governor. January 7, 1828. Annual Message, January 2, 1828. Baltimore *American.*

—— House of Delegates. Internal Improvement Committee. 1825–1826. Report . . . submitted February 10, 1826. *Maryland House of Delegates Journal,* 219–221.

—— House of Delegates. Internal Improvement Committee. February 19, 1827. Report . . . submitted February 15, 1827. Baltimore *American*

—— House of Delegates. Internal Improvement Committee. 1827–1828. Report . . . submitted February 12, 1828. *Maryland House of Delegates Journal,* 268–288.

Massachusetts. Board of Directors of Internal Improvements. Boston, 1828. *Report on the organization of the board and on the prosecution of the surveys for proposed railroads in Massachusetts.* [Massachusetts Senate. 1827–1828 session, document no. 6.]

—— Board of Directors of Internal Improvements. 1829. Report . . . on the practicability and expediency of a railroad from Boston to the Hudson River, and from Boston to Providence. Submitted to the general court, January 16, 1829. Boston, Press of the Boston *Daily Advertiser.*

—— Board of Directors of Internal Improvements. Boston (?), 1829 (?). [Letter from Nathan Hale, vice-president of the board, to Ebenezer Baldwin and Oliver Wiswell, commissioners of the State of New York.]

—— Board of Directors of Internal Improvements. Boston, 1830. *Report . . . transmitted to the Legislature, January Session, 1830.* [Senate document no. 4, January session, 1830.]

—— Commissioners. Boston, 1826. *Report . . . on the routes of canals from Boston harbour to Connecticut and Hudson rivers.*

—— Commissioners. Boston, 1828. *Report of the board of commissioners, for the survey of one or more routes for a railway from Boston to Albany.* [Massachusetts Senate 1827–1828, session 2, document no. 5.]

—— Governor. 1825–1833. Annual Messages.

—— House of Representatives. Boston, 1829. Commission on a railroad from Boston to Providence and from Boston to the Hudson river. *Report . . . on a railroad from Boston to Providence and from Boston to the Hudson river. . . .* [Massachusetts House of Representatives 1828–1829, session 2, document no. 4.]

—— House of Representatives. Committee on roads and railways. Boston, 1828. *Report of the committee . . . on the report of the board of commissioners for the survey of one or more routes for a railway from Boston to Albany and . . . the report of the board of commissioners of internal improvements in relation to the examination of sundry routes for a railway from Boston to Providence . . . February 15, 1828.* [Massachusetts House of Representatives 1827–1828, session 2, document no. 48.]

—— House of Representatives. January 19, 1827. *Report of the select committee of the house of representatives of Massachusetts on the practicability and expediency of constructing a railway from Boston to the Hudson river, at or near Albany.* [House of Representatives document no. 13.]

—— Joint Committee on Railways and Canals. Boston, 1829. *Report on so much of the governor's message as relates to the subject of railways, and also the report of the directors of internal improvements on the practicability and expediency of constructing railroads from Boston to the Hudson river, and also from Boston to Providence. . . .* [House of Representatives document no. 12.]

—— Senate. Committee on Railways and Canals. Boston (?), 1829. *Report on so much of the governor's message as relates to the subject of railways and on the report of the board of directors of internal improvements, on the practicability and expediency of constructing railroads from Boston to the Hudson river, and also from Boston to Providence . . . February 28, 1829.* [Senate document no. 24.]

Pennsylvania. Harrisburg, 1836. *A compilation of the canal and railroad laws of Pennsylvania.*

Pennsylvania Archives. Fourth series **4** and **5**.

Pennsylvania Board of Commissioners for Internal Improvement, 1824–1825. Letters to the secretary of the commonwealth. Pennsylvania House *Journal* **2**: 329–330.

—— 1824–1825. Reported dated February 2, 1825 (signed by Jacob Holgate and James Clarke). Pennsylvania House *Journal* **2**: 239–285.

—— 1824–1825. Report of Charles Trcziyulny . . . dated February 21, 1825. Pennsylvania House *Journal* **2**: 368–377.

Pennsylvania Board of Canal Commissioners, 1826–1833. *Reports.*

—— March and April, 1831. Report of the Engineers relative to a portage railway. *Register of Pennsylvania* **7**: 198–204 by Moncure Robinson; 215–217, 225–228 by S. H. Long.

—— 1852. Reports of the engineers on the Allegheny portage railroad.

Pennsylvania Committee on Inland Navigation and Internal Improvement. 1823–1827. *Reports.*

Pennsylvania. Governor. Harrisburg, 1900. Annual messages to the assembly. *Pennsylvania Archives, Fouth Ser.* **5**: Papers of governors, 1817–1832 (edited by George Edward Reed).

Pennsylvania House. 1832–1833. Report of the grand committee on the canal and railroad system. Pennsylvania House *Journal* **2**: 742–756.

—— 1825–1826. Statements by certain members of reasons for opposition to the mainline canals. Pennsylvania House *Journal* **2**: 326–328.

Pennsylvania Railroad Company. Philadelphia, 1853. Sixth annual report of the directors . . . to the stockholders, February 7, 1853.

Philadelphia Select and Common Councils. Philadelphia, 1846. *Reports of the Joint Special Committee Relative to the Pennsylvania Railroad Company. July 2, 1846.*

U. S. Army. Engineer Department. 1828. *Report on the survey of a canal from the Potomac to Baltimore . . . submitted January 11, 1828.*

U. S. Census Office. Tenth Census. Washington, 1883. Report of the agencies of transportation in the United States. *Census Reports* **4.**

U. S. House. Board of Internal Improvement. 1826. *Report . . . of the Board of Engineers for Internal Improvement, concerning the proposed Chesapeake and Ohio Canal. Submitted December 6, 1826.* [19th Congress, 2nd Session. House document no. 10.]

—— *Two reports on the proposed canal communication between the tide water of the Potomac and the Ohio river—between the Ohio and Lake Erie; between the Allegheny and Schuylkill, or tide water of the Susquehanna . . . submitted February 3, 1825.*

U. S. House. Roads and Canals Committee. April 19, 1825. Report . . . upon . . . internal improvements, February 26, 1825. *Niles' Weekly Register* **28**: 89–95.

—— *Report on the Chesapeake and Ohio Canal, May 22, 1826.* [19th Congress, 1st Session, House document no. 228.]

—— *Report . . . on the Chesapeake and Ohio Canal, January 30, 1827.* [19th Congress, 2nd Session, House Document no. 90.]

—— *Report on the Chesapeake and Ohio Canal, January 2, 1828.* [20th Congress, 1st Session, House Report no. 47.]

—— *Report . . . on the Chesapeake and Ohio Canal, April 17, 1834.* [23rd Congress, 1st Session, House report no. 414.]

U. S. House. 1827. *Report of Surveys, with a view to making roads and canals, March 2, 1827.* [19th Congress, 2nd Session, House Report no. 102.]

U. S. Senate. Washington, 1874. *Report of the Select Committee on transportation routes to the seaboard.* [Windom Report] [43rd Congress, 1st Session, Report no. 307, parts I and II.]

Contemporary Writings

ANONYMOUS. 1821. Comparative calculations . . . illustrative of the advantages to be derived from the improvement of the river Lehigh. Philadelphia.

—— 1825. Facts and arguments in favour of adopting railways in preference to canals in the state of Pennsylvania (fourth edition). Philadelphia.

—— [1825.] Internal improvement: rail roads, canals, bridges, etc. [Philadelphia.]

ARMROYD, GEORGE. 1826. A connected view of the whole internal navigation of the United States. . . . Philadelphia, Carey and Lea.

BAKER, G. W. 1859. A review of the relative commercial progress of the cities of New York and Philadelphia, tracing the decline of the latter to state development, and showing the necessity of trans-Atlantic steamship communication to re-establish foreign trade. Philadelphia.

"(A) BALTIMOREAN (pseud.). 182 Continuation of the numbers of "A Baltimorean," the fi of which were published in the *National Intelligencer. Canals.—Railroads. No. 7.* October 21, 1828. Baltimore.

BEACH, SAMUEL B. (?) [n.p., n.d.] Considerations against continuing the great canal west of the Seneca . . . by Peter Ploughshare.

BOSTON CITIZENS COMMITTEE. January 13, 1827. Report of a committee of the citizens of Boston, on the expediency of a rail road from Boston to the Hudson river. Boston *Daily Advertiser.*

BRECK, SAMUEL. 1818. Sketch of the internal improvements already made by Pennsylvania [second edition]. Philadelphia, M. Thomas.

BROWN, ALEXANDER AND SONS. 1827. The early correspondence of Alex. Brown and sons with regard to the building of the Baltimore and Ohio railroad. Baltimore, Alex. Brown and Sons and the Baltimore and Ohio Railroad.

CAREY, MATHEW. 1830. Address on the formation of a society for the promotion of internal improvement, Philadelphia, October 11, 1824. *Miscellaneous Essays,* 325–328, Philadelphia, Carey and Hart.

—— 1831. Brief view of the system of internal improvement of the state of Pennsylvania. Philadelphia.

[——] 1824. Canal policy, no. I (third edition). Signed Philadelphia, December 8.

[——] 1824. Canal policy, no. II (third edition). Signed Philadelphia, December 13.

[——] 1825. Canal policy, no. III (second edition). Signed Philadelphia, January 13.

[——] 1825. No. IV (second edition). Canal and railroad. Signed Philadelphia, February 14.

[——] 1825. Canal policy no. V (second edition). Signed March 19.

[——] 1825. No. VI Internal improvement. Signed Harrisburg March 19.
(All signed "Fulton"; all bound together in pamphlet in Historical Society of Pennsylvania.)

—— Diary. December 15, 1822 to June 16, 1826. Ms. University of Pennsylvania Library.

[——] 1830(?). Essay on railroads. Signed "Hamilton" (pseud.), Philadelphia(?), January 14.

[——] [1829.] Internal improvement. Signed "Hamilton" [Philadelphia].

[——] [1829.] Internal improvement no. II. Signed "Hamilton." [Philadelphia].

[——] 1825. Internal improvement, nos. I–VI. Railways and canals. All signed "Hamilton": Sept. 26; Oct. 5; Nov. 28; Dec. 7; Dec. 26.

[——]. 1826. Internal improvement. New Series, I and II. Both signed "Fulton": January 19; January 31.

[——] [1828 (?)]. Pennsylvania canals. Signed "Hamilton." [Philadelphia(?)].

[——] 1827. Railroads. Signed "Hamilton." September 18, Philadelphia.

[——] 1827. To the citizens of the commonwealth of Pennsylvania: internal improvement. Signed, "M.C., Philadelphia, March 6, 1827."

Chesapeake and Ohio Canal Convention. 1827. Proceedings . . . on the sixth day of November, 1823 and re-assembled . . . on the sixth day of December, 1826. Washington.

CHEVALIER, MICHEL. 1840–1841. Histoire et description des voies de communication aux Etats-Unis. 2 v. Paris.

—— 1839. Society, manners and politics in the United States . . . Boston, Weeks, Jordan.

Concord, New Hampshire, Internal Improvement Convention. 1825. Facilitated carrying: a short statement of the proceedings at Concord, N. H. on . . . the third day of June, 1825, on the subject of internal improvement. . . . Boston, from the Commercial Gazette Press.

DAY, SHERMAN. [1843]. Historical collections of the state of Pennsylvania. . . . Philadelphia, George W. Gorton.

DEARBORN, H[ENRY] A. S. 1839. Letters on the internal improvements and commerce of the west. Boston.

DUANE, WILLIAM J. 1811. Letters addressed to the people of Pennsylvania respecting the internal improvement of the commonwealth. . . . Philadelphia.

EARLE, THOMAS. 1830. A treatise on rail-roads and internal communications. . . . Philadelphia.

GERSTLER, FRANZ ANTON, RITTER VON. 1827. Memoire sur les grandes routes . . . précédé d'une introduction par M. P. S. Girard. Paris.

GRAY, THOMAS. 1825. Observations on a general iron railroad . . . (fifth edition). London.

GRUND, FRANCIS J. 1837. The Americans in their moral, social, and political relations. 2 v. London, Longman.

[HALE, NATHAN]. 1829. Massachusetts railroad. *North American Review* **28**: 522–537.

[——] 1837. Poussin on American railroads. *North American Review* **44**: 435–461.

[——] 1827. Remarks on the practicability and expediency of establishing a rail road on one or more routes from Boston to the Connecticut river. By the editor of the Boston *Daily Advertiser*. Boston.

[——] 1829. Remarks on the practicability and expediency of railroads from Boston to the Hudson river and from Boston to Providence. From the Boston *Daily Advertiser*. Boston.

HARPER, [ROBERT GOODLOE]. 1824. General Harper's speech to the citizens of Baltimore on . . . a connexion between the Ohio at Pittsburgh and the waters of the Chesapeake, at Baltimore, by a canal . . . delivered . . . on the 20th day of December, 1823. Baltimore.

[Harrisburg, Pennsylvania, Internal Improvement Convention, 1825]. Address to the citizens of Pennsylvania on the subject of internal improvements, by a committee appointed by the convention.

Harrisburg Internal Improvement Convention. 1825. Report of debates, in *Niles' Weekly Register*, September 24, **29**: 59–63.

Harrisburg [Pennsylvania] Railroad Convention. 1838. Proceedings. March 6–8. Philadelphia.

[HOLLINS, WILLIAM]. 1827. Railroads in the United States of America; or protest and argument against a subscription on the part of the state of Maryland, to the Baltimore and Ohio rail-road company . . . by a citizen of Baltimore. Baltimore.

—— 1825. Views on the subject of internal improvement between the Atlantic and western states, [Signed January 1, 1825]. Baltimore.

JACKSON, WILLIAM. 1829. Lecture on railroads, delivered January 12, 1829 before the Mass. Charitable Mechanic Association (third edition). Boston.

KANE, JOHN K. (1854). William Strickland [an obituary notice]. *Proc. Amer. Philos. Soc.* **6**: 28–32.

LATROBE, JOHN H. B. 1826. The Baltimore and Ohio railroad: personal recollections. Baltimore.

LONG, S[TEPHEN] H. 1827. Letter from Lieut. Col. S. H. Long, United States topographical engineer, to Philip E. Thomas, esquire. April 26., In *Three Papers on Rail-Roads from the American Farmer*. Philadelphia.

LONG, STEPHEN HARRIMAN, and W. G. MCNEILL. 1830. Narrative of the proceedings of the board of engineers of the Baltimore and Ohio Rail Road Company, from its organization to its dissolution, together with an exposition of facts, illustrative of the conduct of sundry individuals. 2 v. Baltimore.

MILLS, ROBERT. 1834. Substitute for railroads and canals: embracing a new plan of roadway. Washington.

Pennsylvania Society for the Promotion of Internal Improvement in the Commonwealth. 1825. Address to the citizens of Pennsylvania. In *United States Gazette*, January 25.

—— 1825. Constitution. In *Poulson's American Daily Advertiser*, March 24.

—— 1825. Memorial to the Pennsylvania Legislature. In *United States Gazette*, February 10.

—— 1825. Railways (second edition). A digest of Robert Stevenson's essay written for the Highland Society of Edinburgh, with a preface, dated March 22, 1825, by the Acting Committee of the Pennsylvania Society.

Pennsylvania Society for the Promotion of Internal Improvement in the Commonwealth. Acting Committee. 1825. Address, in *United States Gazette*. February 11.

—— 1826. Address, dated February 1, 1826. Signed Mathew Carey, Vice-President.

—— 1826. First annual report of the acting committee. Philadelphia.

—— [1825]. Extracts from the correspondence with William Strickland. n.p.

—— 1825. To the citizens of the commonwealth of Pennsylvania. In *United States Gazette*, March 22.

—— 1826. The union canal. Paper read at a meeting of the Acting Committee. Dated August 26, 1826. Signed "p." Philadelphia.

PHENIX, THOMAS. 1825. The state convention on internal improvements, containing the resolutions . . . together with an appendix containing the views of Thomas Ellicott. . . . Baltimore.

Philadelphia Board of Trade. 1836. Report . . . on the causes of delay in the transportation of merchandise westward, in the spring of 1836.

Philadelphia Board of Trade. Delegation. 1860. Narrative of the excursion to the west made by the delegation of the board of trade of Philadelphia. Reprinted from the letters published in the Philadelphia *Inquirer* from its special correspondent. Philadelphia.

Proceedings of sundry citizens of Baltimore. 1827. Baltimore.

ROBERTS, SOLOMON W. 1879. Reminiscences on the first railroad over the Allegheny mountain. Philadelphia.

ROGERS, JOHN. 1827. Statements, calculations and hints relative to rail-roads. . . . Baltimore.

SHRIVER, JAMES. 1824. An account of the surveys and examinations . . . relative to the projected Chesapeake and Ohio and Lake Erie canals. Baltimore.

STEVENS, JOHN. 1917. Documents tending to prove the superior advantages of rail-ways and steam-carriages over canal navigation. New York, 1812. Reprinted in *Magazine of History* **14**, extra no. 54.

STRICKLAND, WILLIAM. 1826. Reports on canals, railways, roads, and other subjects, made to the "Pennsylvania Society for the promotion of internal improvement." Philadelphia, H. C. Carey and I. Lea.

STRONG, HENRY K. 1845. Mainline of state works of Pennsylvania. *Hunt's Merchants' Magazine* **13**: 127–138. August.

SULLIVAN, J[OHN] L[ANGDON]. 1824. Suggestions on the canal policy of Pennsylvania. . . . Philadelphia.

TANNER, H. S. 1840. A description of the canals and railroads of the United States. . . . New York, Tanner and Disturnell.

TANNER, HENRY S. 1829. Memoir on the recent surveys, observations and internal improvements in the United States . . . intended to accompany his new map of U. S.

TREDGOLD, THOMAS. 1825. A practical treatise on railroads and carriages. . . . New York, E. Bliss and E. White.

TYSON, JOB R. 1852. Letters on the resources and commerce of Philadelphia. . . . Philadelphia.

—— *et al.* 1846. The Pennsylvania railroad: address of the committee of seven to the citizens of Philadelphia. . . . Philadelphia.

WARD, MINUS. 1827. Remarks, propositions and calculations, relative to a rail-road and locomotive engines to be used upon the same, from Baltimore to the Ohio river. Baltimore.

WOOD, NICHOLAS. 1832. A practical treatise on rail-roads, first American edition, from the second English edition, edited by George Washington Smith. Philadelphia, Carey & Lea.

Secondary Studies

ABBOTT, FREDERICK K. 1952. The role of the civil engineer in internal improvements: the contributions of the two Loammi Baldwins, father and son, 1776–1836. Unpublished dissert., Columbia.

ADAMS, CHARLES FRANCIS, JR. 1868. Boston, *North American Review* **106**: 1–25. January.

—— 1883. The canal and railroad enterprise of Boston. *The Memorial History of Boston*, edited by Justin Winsor, **4**: chap. 5, 111–150. Osgood & Co.

—— 1887. Railroads: their origin and problems (revised edition). New York, G. P. Putnam's Sons.

ADAMS, HERBERT B. 1885. Maryland's influence upon land cessions to the United States. Johns Hopkins Univ. Studies in Historical and Political Science, 3rd ser. **1**. Baltimore, Johns Hopkins Univ.

ALBION, ROBERT G. 1931. New York Port and its disappointed rivals, 1815–1860. *Jour. Business and Economic History* **3**. August.

—— 1939. The rise of New York port. New York, Scribner's.

ALLEN, HORATIO. 1884. The railroad era, first five years of its development. New York.

AMBLER, CHARLES H. 1932. A history of transportation in the Ohio valley. Glendale, California, Arthur H. Clark Co.

ANDREWS, ISRAEL D. 1854. Report . . . on the trade and commerce of the British North American colonies, and upon the trade of the great lakes and rivers. . . . Senate Exec. Doc. 112, First Session, 32nd Congress. Washington.

BALTZELL, E. DIGBY. 1958. The Philadelphia gentlemen: the making of a national upper class. Glencoe, Ill., Free Press.

BEAHAN, WILLARD. 1904. The field practice of railway location. New York, Engineering News Publishing Co.

BELCHER, WYATT W. 1947. The economic rivalry between St. Louis and Chicago, 1850–1880. New York, Columbia Univ. Press.

BELL, JOSEPH SNOWDEN. 1912. The early motive power of the Baltimore and Ohio railroad. New York, Angus Sinclair.

BENSON, LEE. 1955. Merchants, farmers, and railroads: railroad regulation and New York politics, 1850–1887. Cambridge, Harvard Univ. Press.

BISHOP, AVARD L. 1907. The state works of Pennsylvania. In *Trans. Conn. Acad. Arts and Sciences* **13**: 147–297. November.

BLISS, GEORGE. 1863. Historical memoir of the Western Railroad. Springfield, Mass., Samuel Bowles.

BRIDENBAUGH, CARL and JESSICA. 1942. Rebels and gentlemen: Philadelphia in the age of Franklin. New York, Reynal and Hitchcock.

BRIGHAM, ALBERT P. 1925. Geographical influences in American history. Boston, Ginn and Co.

BUCK, SOLON J. and ELIZABETH H. 1939. The planting of civilization in western Pennsylvania. Pittsburgh, Univ. of Pittsburgh Press.

BURGESS, GEORGE H., and MILES C. KENNEDY. 1949. Centennial history of the Pennsylvania Railroad Company, 1846–1946. Philadelphia, Pennsylvania Railroad Company.

CAIRNS, JAMES P. 1950. Response of New Orleans to diversion of trade from the Mississippi river, 1845–1860. Unpublished master's essay, Columbia Univ.

CALLENDER, G. S. 1954. The early transportation and banking enterprise of the states in relation to the growth of corporations. *Quart. Jour. Economics* **17** (1903), as reprinted in *Economic Change in America*, 522–559. Edited by Joseph T. Lambie and Richard V. Clemence. Harrisburg, Stackpole Company.

CARTER, CHARLES FREDERICK. 1909. When railroads were new. New York, Henry Holt.

CHANDLER, ALFRED O., JR. 1956. Henry Varnum Poor: business editor, analyst, and reformer. Cambridge, Harvard Univ. Press.

CLARK, JOSEPH S., JR. 1929. The railroad struggle for Pittsburgh: forty-three years of Philadelphia-Baltimore rivalry, 1838–1871. *Penn. Mag. Hist. and Biog.* **48**: 1–37.

CLARK, VICTOR S. 1949. History of manufactures in the United States 1. New York, McGraw-Hill.

CLEVELAND, FREDERICK A., and FRED WILBUR POWELL. 1909. Railroad promotion and capitalization in the United States. New York, Longmans, Green.

COHEN, MENDES. 1892. Address at the annual convention. . . . In *Trans. Amer. Soc. Civil Engineers* **26**: 535–558. June.

CRANMER, H. JEROME. 1955. The New Jersey canals. A study of the role of government in economic development. Unpublished dissertation, Columbia Univ.

DEAN, WILLIAM H., JR. 1938. The theory of geographic location of economic activities, with special reference to historical change. Unpublished dissertation, Harvard Univ.

DORSEY, EDWARD BATES. 1887. English and American railroads compared (2nd ed.). New York, Wiley and Sons.

DUNAWAY, WAYLAND F. 1948. A history of Pennsylvania (2nd ed.). New York, Prentice-Hall.

DUNBAR, SEYMOUR. 1915. A history of travel in America. 4 v. Indianapolis, Bobbs-Merrill Co.

DUNHAM, ARTHUR L. 1946. The pioneer period of European railroads. (Publication No. 3 of the Kress Library of Business and Economics.) Boston, Baker Library, Harvard Graduate School of Business Administration.

DURRENBERGER, JOSEPH AUSTIN. 1931. Turnpikes: a study of the toll road movement in the middle Atlantic states and Maryland. Valdosta, Ga.

ELLIS, DAVID M. 1952. New York and the western trade, 1850–1910. *New York History* **33**: 379–396. October.

EMERSON, F. V. 1908–1909. A geographical interpretation of New York City. *Bull. Amer. Geog. Soc.* **40**: 587–612, 721–739; **41**: 3–21.

FEBVRE, LUCIEN. 1925. A geographical introduction to history. New York, Knopf.

FERGUSON, RUSSELL J. 1930. Early western Pennsylvania politics. Pittsburgh, Univ. of Pittsburgh Press.

FISHER, CHARLES E. 1947. Whistler's railroad: the Western Railroad of Massachusetts. *Bull. Railway and Locomotive Hist. Soc.*, No. 69: 5–102. May.

GILCHRIST, AGNES ADDISON. 1950. William Strickland, architect and engineer, 1788–1854. Philadelphia, Univ. of Penna. Press.

GILMORE, HARLAN W. 1953. Transportation and the growth of cities. Glencoe, Ill., The Free Press.

GOODRICH, CARTER. 1956. American development policy: the case of internal improvements. *Jour. Economic Hist.* **16**: 449–460. December.

—— 1960. Government promotion of American canals and railroads. New York, Columbia Univ. Press.

GOULD, CLARENCE P. 1931. The economic causes of the rise of Baltimore. *Essays in colonial history presented to Charles McLean Andrews*, 225–251. New Haven, Yale Univ. Press.

GREEN, CONSTANCE MCLAUGHLIN. 1957. American cities in the growth of the nation. London, Univ. of London.

GREGG, DOROTHY. 1951. The exploitation of the steamboat: the case of Colonel John Stevens. Unpublished dissertation, Columbia Univ.

HANDLIN, OSCAR, and MARY FLUG HANDLIN. 1947. Commonwealth. A study of the role of government in the American economy: Massachusetts, 1774–1861. New York, New York Univ. Press.

HANEY, LEWIS H. 1908. A congressional history of railways in the United States to 1850. *Bull. Univ. of Wisconsin*, No. 211. Madision, Wisconsin.

HARLOW, ALVIN F. 1926. Old towpaths: the story of the American canal era. New York and London, D. Appleton.

—— 1946. Steelways of New England. New York, Creative Age Press.

HARRINGTON, VIRGINIA D. 1935. The New York merchant on the eve of the revolution. New York, Columbia Univ. Press.

HARRISON, JOSEPH A., JR. 1954. The internal improvement issue in the politics of the union, 1783–1825. Unpublished dissertation, Univ. of Virginia.

HARTZ, LOUIS. 1948. Economic policy and democratic thought: Pennsylvania, 1776–1860. Cambridge, Harvard Univ. Press.

HENRY, ROBERT SELPH. 1942. This fascinating railroad business. Indianapolis and New York, Bobbs-Merrill Co.

HEYDINGER, EARL J. 1954. The English influence on American railroads. *Bull. Railway and Locomotive Hist. Soc.*, no. 91: 7–45. October.

HILL, BENJAMIN THOMAS. 1901. The beginnings of the Boston and Worcester railroad. *Proc. Worcester Soc. of Antiquity*, 527–576.

HODGE, CHARLES L. 1932. Economic beginnings of the Boston and Albany railroad, 1831–1867. *Facts and factors in economic history*, 446–469. Cambridge, Harvard Univ. Press.

HOELTZEL, MAX. 1935. Aus der Frühzeit der Eisenbahnen: mit einen bibliographie. Berlin, Verlag von Julius Springer.

HOLLAND, JOSEPH GILBERT. 1855. History of Western Massachusetts **1**. Springfield, Samuel Bowles.

HULBERT, ARCHER B. 1920. The paths of inland commerce. New Haven, Yale Univ. Press.

HUNGERFORD, EDWARD. 1928. The story of the Baltimore and Ohio railroad, 1827–1927. 2 v. New York and London, G. P. Putnam's Sons.

HUNTER, LOUIS C. 1949. Steamboats on the western waters: an economic and technological history. Cambridge, Harvard Univ. Press.

ISARD, WALTER. 1943. The economic dynamics of transport technology. Unpublished dissertation, Harvard Univ.

JACKMAN, W. T. 1916. The development of transportation in modern England. 2 v. Cambridge, at the Univ. Press.

JAMES, ALFRED R. 1953. Sidelights on the founding of the Baltimore and Ohio railroad. *Maryland Hist. Mag.* **48**: 267–309. December.

JOHNSON, EMORY R. 1908. Geographical influences affecting the early development of American commerce. *Bull. Amer. Geog. Soc.* **40**: 129–143. March.

—— *et al.* 1915. History of domestic and foreign commerce in the United States **1**. Carnegie Institution.

KENT, FRANK R. 1925. The story of Alexander Brown and Sons. Baltimore, Alexander Brown and Sons.

KIRKLAND, EDWARD CHASE. 1948. Men, cities, and transportation: a study of New England history, 1820–1900 **1**. Cambridge, Harvard Univ. Press.

—— 1945. The "railroad scheme" of Massachusetts. *Jour. Economic Hist.* **5**: 145–171. November.

KLEIN, PHILIP SHRIVER. 1940. Pennsylvania politics, 1817–1832: a game without rules. Philadelphia, Hist. Soc. Penna.

KLEIN, THEODORE B. 1901. The canals of Pennsylvania and the system of internal improvements of the commonwealth. *Annual Report of the Secretary of Internal Affairs of the Commonwealth of Pennsylvania for the year ending June 30, 1901*, Part IV: lxiv–lxxxix.

LIVINGOOD, J AMES WESTON. 1947. The Philadelphia-Baltimore trade rivalry, 1780–1860. Harrisburg, Pennsylvania Hist. & Museum Commission.

LORING, LOUIS P. 1894. Early railroads in Boston. *Bostonian* **1**: 299–309. December.

MARSHALL, C. F. DENDY. 1938. A history of British railways down to the year 1830. London, Oxford Univ. Press.

MCCLURE, A. K. 1905. Old time notes of Pennsylvania. 2 v. Philadelphia, John C. Winston Co.

MACGILL, CAROLINE E. 1948. History of transportation in the United States before 1860. (Prepared under the direction of Balthasar H. Meyer.) Washington, Peter Smith (reprint).

MCMASTER, JOHN BACH. 1895. A history of the people of the United States, from the revolution to the civil war. 6 v. New York, D. Appleton.

—— 1918. The life and times of Stephen Girard. 2 v. Philadelphia, J. B. Lippincott.

MCPHERSON, LOGAN G. 1910. Transportation in Europe. New York, Henry Holt.

MEIGS, WILLIAM M. 1897. The life of Charles Jared Ingersoll. Philadelphia, J. B. Lippincott.

MITMAN, CARL W. 1930. The beginnings of the mechanical transport era in America. (From the Smithsonian Report for 1929, 507–558.) Washington, U. S. Printing Office.

MODDY, JOHN. 1921. The railroad builders. New Haven, Yale Univ. Press.

MOULTON, HAROLD G. 1912. Waterways versus railways. Boston and New York, Houghton Mifflin Co.

NETTELS, CURTIS. 1930–1931. The economic relations of Boston, Philadelphia and New York, 1680–1715. *Jour. Economic and Business Hist.* **3**: 185–215.

PARKINS, A. E. 1916–1917. The development of transportation in America. *Bull. Geog. Soc. Phila.* **14**: 92–114, 148–168; **15**: 1–18.

PIERCE, HARRY N. 1953. Railroads of New York: a study of government aid, 1826–1875. Cambridge, Harvard Univ. Press.

PLUMMER, WILBUR C. 1925. The road policy of Pennsylvania. Philadelphia.

POMERANTZ, SIDNEY I. 1938. New York: an American city, 1783–1803. A study of urban life. New York, Columbia Univ. Press.

POOR, HENRY V. 1860. History of the railroads and canals of the United States of America . . . **1**. New York, John H. Schultz.

—— 1881. Sketch of the rise and progress of the internal improvements . . . of the United States. . . . (Reprinted from the Manual of the Railroads of the United States for 1851.) New York, H. V. and H. W. Poor.

REA, SAMUEL. 1928. Engineering reminiscences. Jour. *Franklin Institute* **202**: 165–175. August.

REISER, CATHERINE ELIZABETH. 1951. Pittsburgh's Commercial development, 1800–1850. Harrisburg, Penna. Hist. and Museum Commission.

REIZENSTEIN, MILTON. 1897. The economic history of the Baltimore and Ohio railroad, 1827–1853. Johns Hopkins Univ. Studies, 15th Ser. **7** and **8**. Baltimore, Johns Hopkins Univ. Press.

RINGWALT, J. L. 1888. Development of transportation systems in the United States. Philadelphia.

ROWE, KENNETH WYER. 1933. Mathew Carey: a study in American economic development. Johns Hopkins Univ. Studies in Hist. and Polit. Science **51** (4). Baltimore, Johns Hopkins Univ. Press.

RUSSEL, R. R. 1928. A reevaluation of the period before the civil war: railroads. *Miss. Valley Hist. Review* **15**: 341–354.

SADOVE, ABRAHAM H. 1950. Transport improvement and the Appalachian barrier: a cost study in economic innovation. Unpublished dissertation, Harvard Univ.

SANDERLIN, WALTER S. 1946. The great national project: a history of the Chesapeake and Ohio canal company. Johns Hopkins Univ. Studies in Hist. and Polit. Science **64** (1). Baltimore, Johns Hopkins Univ. Press.

SCHMIDT, LOUIS BERNARD. 1939. Internal commerce and the development of the national economy before 1860. *Jour. Polit. Economy* **47**: 798–822. December.

SCHUMPETER, JOSEPH A. 1939. Business cycles. 2 v. New York and London, McGraw-Hill.

—— 1934. The theory of economic development. Cambridge, Harvard Univ. Press.

SEGAL, HARVEY H. 1956. Canal Cycles, 1834–1861: public construction experience in New York, Pennsylvania and Ohio. Unpublished dissertation. Columbia Univ.

SEMPLE, ELLEN C. 1933. American history and its geographic conditions (1903; revised edition, 1933). Boston, Houghton Mifflin.

SHELLING, RICHARD I. 1938. Philadelphia and the agitation in 1825 for the Pennsylvania canal. *Penna. Mag. Hist. and Biog.* **62**: 175–204. April.

SIMPSON, STEPHEN. 1832. Biography of Stephen Girard. . . . Philadelphia, Thomas L. Bonsal.
SMITH, J. E. A. 1876. The history of Pittsfield (Berkshire County), Massachusetts, from . . . 1800 to . . . 1876. Springfield.
SMITH, WILLIAM PRESCOTT. 1858. The book of the great railway celebrations of 1857. New York, D. Appleton.
—— 1853. A history and description of the Baltimore and Ohio railroad . . . by a citizen of Baltimore. Baltimore.
STARR, JOHN W., JR. 1928. One hundred years of American railroading. New York, Dodd, Mead.
STEPHENS, GEORGE WARE. 1923. Some aspects of early intersectional rivalry for the commerce of the upper Mississippi valley. *Washington Univ. Studies, Humanistic Series* **10**: 277–300. April.
STEVENSON, DAVID. 1838. Sketch of the civil engineering of North America. London, John Weale.
TAYLOR, GEORGE R., and IRENE D. NEU. 1956. The American railroad network, 1861–1900. Cambridge, Harvard Univ. Press.
TAYLOR, GEORGE ROGERS. 1951. The transportation revolution, 1815–1860. New York, Rinehart and Co.
TURNBULL, ARCHIBALD DOUGLAS. John Stevens. New York and London, Century Co.
VAN METRE, THURMAN. n.d. Early opposition to the steam railroad. [New York], Columbia Univ. School of Business.
VAN METRE, T. W. 1950. Transportation in the United States. Second edition. Brooklyn, Foundation Press.
VEITCH, GEORGE S. 1930. The struggle for the Liverpool and Manchester railway. Liverpool, Daily Post, Printers.
VOSE, GEORGE L. 1889. Notes relating to the early history of transportation in Massachusetts. *Jour. Assoc. Engineering Societies* **4**: 53–72. November.
—— 1885. A sketch of the life and works of Loammi Baldwin. . . . Boston.
WALTERS, RAYMOND, JR. 1957. Albert Gallatin. New York, Macmillan.
WARD, GEORGE WASHINGTON. 1899. The early development of the Chesapeake and Ohio canal project. *Johns Hopkins Univ. Stud. in Hist. and Polit. Science, Series 17,* (9) (10) (11). Baltimore, Johns Hopkins Univ. Press.
WHITFORD, NOBLE E. 1906. History of the canal system of the State of New York. (Supplement to the Annual Report of the State Engineer and Surveyor of the State of New York for 1904–1905.) 2 v. Albany.
WILLOUGHBY, WILLIAM R. 1951. Early American interest in waterway connection between the east and the west. *Indiana Mag. of History* **52**: 319–342. December.
WILSON, W. HASELL. 1879. Notes on the internal improvements of Pennsylvania. Philadelphia.
—— 1896. Reminiscences of a railroad engineer. Philadelphia, Railway World Publishing Co.
WILSON, WILLIAM BENDER. 1899. History of the Pennsylvania Railroad Company. 2 v. Philadelphia, Henry T. Coates.
WINCHESTER, PAUL. 1927. The Baltimore and Ohio Railroad. Baltimore, Maryland County Press Syndicate.

Bibliographies

Bureau of Railway Economics. 1912. Railway economics: a collective catalogue of books in fourteen American libraries. Chicago, Univ. of Chicago Press.
—— 1924. Survey of original sources of railway information (mimeographed). June.
FREEMAN, EDMUND ARTHUR. 1927. The Baltimore and Ohio Railroad Company and its subsidiaries: a bibliography. Washington, Bureau of Railway Economics.
Historical Records Survey. New Jersey. 1940. Calendar of the Stevens family papers. Preliminary volume. Newark, Hist. Records Survey.
—— Handwritten work sheets of the W.P.A. project that produced the preliminary volume of the calendar of the Stevens family papers. Library of the Stevens Institute of Technology, Hoboken, New Jersey.
LEE, JOHN W. M. 1879. A bibliography of the Baltimore and Ohio Rail Road Company, 1827 to 1879. Baltimore.
THOMSON, THOMAS RICHARD. 1942. Check list of publications on American railroads before 1841. New York, New York Public Library.

Periodicals

American Mechanics' Magazine. 1 & 2. 1825–1826. New York.
The Franklin Journal and American Mechanics' Magazine. 1826–1885. Philadelphia.
Hunt's Merchants' Magazine. 1850. New York.
Niles' Weekly Register. 1811–1849. Baltimore.
North American Review. 1822–1868. Boston.
Bulletin of the Railway and Locomotive Historical Society. (1–93).
Register of Pennsylvania. Philadelphia.

Newspapers

Baltimore American and Commercial Daily Advertiser. 1827.
Baltimore Gazette and Daily Advertiser. 1827.
Baltimore Patriot and Mercantile Advertiser. 1827.
Boston Daily Advertiser. 1826 and 1827.
Boston Statesman. 1826.
Maryland Republican. January and February. 1827. Annapolis.
National Gazette. January–April. 1825. Philadelphia.
Poulson's American Daily Advertiser. 1825. Philadelphia.
United States Gazette. 1825 and 1826. Philadelphia.
Worcester (Mass.) National Aegis (wkly.) September–December. 1826.

INDEX

Adams, Charles Francis, Jr., 89, 93
Adams, George W., and Phelps Committee, 84
Adams, John Quincy, 69
Albany, N. Y., 5; and trade with New York, 81
Alexandria, Va., *see* Potomac cities
Alleghenies, and canal tunnel, 6, 20–21; *see also* Trans-Appalachian projects
Allegheny River, and mainline canal route, 57
"Alnus," 42, 44 n. 111, 48 n. 134; and vested interests, 56
American Farmer, 61
American Railroad Journal, quoted, 78
Andrews Report, 94
Appalachians, *see* Alleghenies

Baldwin, James F., 89
Baldwin, Loammi, II, 80–88 *passim*
Baltimore, Md., 6, 63–75; canal interest in, 8, 12, 63–69, 73; and comparison with Massachusetts, 9, 14, 69, 80; and comparison with Pennsylvania, 9, 13–14, 63, 72–79; and decision for railroad, 8, 13, 48, 60, 63, 70, 72; geographic factors in, 9, 12, 64, 65; problem of internal improvement in, 6, 12–14; and trade, 6, 9, 63–67, 78; *see also* Baltimore and Ohio Railroad; Chesapeake and Ohio Canal; Maryland
Baltimore American, and canal-railroad debate in Maryland, 61, 73–76
Baltimore and Ohio Railroad, 17, 63–75; and finance, 71; and litigation with Chesapeake and Ohio Canal, 71; organization of, 63, 69–72, 75; origin of, 69–72; profile map of, 11; route described, 71
Baltimore Exchange, 77
Baltimore Gazette, 73, 75
Baltimore Patriot, 73, 75
Baltimore press, and railroad-canal isssue, 71, 73, 75; *see also* specific Baltimore papers
Bank of the United States, and non-renewal of charter, 93
Belmont Coal Mines, railroad proposed, 44
Berkshire County, Mass.: marble of, 86; railroad interest in, 84; trade of, 82
Bernard, General S., 67
Binney, Horace, 22
Birmingham and Liverpool Railroad, 22, 24, 31
Birmingham and London Railroad, 22
Bishop, Avard L., *State Works of Pennsylvania*, 51
Blackstone Canal, effects of, 90–91, 95
Board of Canal Commissioners, in Pennsylvania, 20–21, 25
Board of Internal Improvement of Massachusetts, creation of, 88–89
Boston, Mass., 80–96; and canal, 9, 14, 80–87; and railroad, 8, 18, 80–93; and trade, 6, 9, 95; *see also* Massachusetts
Boston and Albany Railroad, 18; formation of, 94; profile map of, 10; *see also* Boston and Worcester Railroad; Western Railroad
Boston Courier, 83, 88
Boston Daily Advertiser, 76, 82–83, 88, 95
Branch canals, *see* Canals; Maryland; Massachusetts; Pennsylvania
Boston and Lowell Railroad, 91–92
Boston and Providence Railroad, 92
Boston and Worcester Railroad, 91–94
Boston press, and railroads, 83; *see also* specific Boston papers
Brown, Alexander, 77–78
Brown, George, and Baltimore and Ohio Railroad, 70
Bryant, Gridley, 83, 87
Buckingham, Joseph T., 88
Buffalo, N. Y., 5–6

Canals: over Appalachian barrier, 6; costs of, 35–36; disadvantages of, 85; history, in America, 5, 42; in Maryland, 63–72; in Massachusetts, 80–96; in Pennsylvania, 29–60; portage issue in 38; and time required to move freight, 70; water vibration and speed of, 30; *see also* canal-railroad debate; Maryland; Massachusetts; Pennsylvania
Canal Commissioners, in Pennsylvania, 21–60 *passim*
Canal mania, 5–6, 13; and conflict with railroad in Pennsylvania, 52; in Maryland, 65–73 *passim; see also* Maryland; Massachusetts; Pennsylvania
Canal-railroad debate, 8; and economic development argument, 41; experience as crucial aspect in, 41–42; in Massachusetts, 80–87; in Pennsylvania, 29–52; in Potomac Valley, 63–72; technical and cost issues of, 29; velocity argument in, 31; *see also* canals, Maryland; Massachusetts; Pennsylvania; railroads
Canal tunnels: in Maryland, 64; in Massachusetts, 83; in Pennsylvania, 20–21, 35, 52; *see also* canals; Maryland; Massachusetts; Pennsylvania
Carey, William, and role in Pennsylvania Society, 15–61 *passim;* 82, 94
Carroll, Charles, 77
Central Committee, Washington convention, 64, 68
Champlain Canal, 61, 65
Charles River bridge, case of, 91
Chesapeake and Delaware Canal, project of, 50
Chesapeake and Ohio Canal, 8, 12, 19, 74; and analogy to Erie, 64; Baltimore participation in, 63-73 *passim;* chartered by Virginia, 66; and confirmation by Maryland legislature, 66; and confirmation by Pennsylvania, 66; financing of, 64–65; and litigation with Baltimore and Ohio Railroad, 71; national objectives of, 65; organization of, 64, 66, 72; profile map of, 11; *see also* U. S. Board of Internal Improvement, reports
Cincinnati, O., and turnpikes, 6
Cincinnati Commercial Register, 76
Clarke, James, 20
Cleveland, O., and turnpikes, 6
Columbia, Pa., 18
Committee of the Citizens of Boston, 85–86; *see also* Massachusetts
Committee of the Harrisburg Convention, *see* Harrisburg Convention
Committee on Internal Improvements of Maryland House of Delegates, 67
Committee of Sundry Citizens, *see* Sundry Citizens
Committee on Roads and Canals, Maryland, 68
Concord, N. H., internal improvement meeting in, 80
Conemaugh Valley, salt production in, 16
Corps of Engineers, survey by, 66; *see also* U. S. Engineers
Coulomb and Vince, experiments of, 46
Cumberland road, 19

Dearborn, Henry A. S., 80
Decision-making groups, psychological traits of, 12–14, 56–57, 75–80, 94–96; *see also* Improvement leaders
Delaware and Ohio Canal, suggested, 19
Delaware and Raritan, railroad proposed for, 61
Depression of 1842, in Pennsylvania, 59
Duane, William J., 26, 54

Economic development argument, in Pennsylvania, 13, 41; *see also* Pennsylvania
Edge rail, importance of, 34
Ellicott, Thomas, 67
England, *see* Great Britain
Erie Canal, 5–19 *passim;* and competition with proposed Potomac Canal, 53; cost of, 35–36, 65, 86; and economic development of New York, 33, 39; and effect in Baltimore, 76, 78; and effect in Massachusetts, 80–81, 86–87; and effect in Pennsylvania, 48–50; lockage on, 52; profile map of, 10, 11; risks in decision for, 41; success of, 6, 50, 81, 86, 94; and trade, 16, 65
Eustis, William, Governor of Massachusetts, and canal, 80
Evans, Oliver, prediction on railroads of, 75
"Examiner," opponent to Carey, 34, 42, 44 n. 109, 55–56

Facts and Arguments, 26–56 *passim*, 91
Federal aid, for Chesapeake and Ohio Canal, 64
Frederick, Md., canal agitation in, 67
Friction, and railroad speed, 30, 46
Friction wheel, invention of, 77, and use on railroad, 33

Gallatin, Albert, 19; report of, 54, 66
Geddes, James, 69, 72
Georgetown, Va., and canal route, 64; *see also* Potomac cities
Girard, Stephen, 22
Granite Railroad, 12, 61, 73, 83–88 *passim*
Great Britain, and railroad: experiences with, 6–8, 37; finances of, 35, 38, 42; prediction of boom in, 43; *see also* railroad; railroad mania

Hale, Nathan, 82–95 *passim*
Hampshire County, Mass., 86
Harper, Robert Goodloe, 65, 74
Harrisburg, Pa., convention, and Pennsylvania Mainline, 20, 25, 36, 44, 46, 49, 51, 55, 59
Hartz, Louis, *Economic Policy and Democratic Thought*, 51
Henshaw, David, 83
Holgate, Jacob, 20
Hollidaysburg, Pa., 15, 18, 58
Housatonic Valley, 82
Howard, Benjamin C., 70
Howard, John Eager, 70
Howard, William, 71
Hoyt, Elihu, 80
Hudson River Railroad, 17
Hunt's Merchants' Magazine, 40

Improvement leaders: in Baltimore, 75–79; in Massachusetts, 80, 88; in Pennsylvania, 52, 56, 60
Improvement propaganda in Pennsylvania, 50; and comparison with Baltimore, 65, 75
Ingersoll, Charles J., 25–26
Internal improvement, *see* Baltimore; Boston; Philadelphia
Internal improvement convention: at Harrisburg (*see* Harrisburg Convention); at Washington (*see* Central Committee)
Interregional railroads, *see* specific railroad lines

Jessop, William, English engineer, 32, 34, 42
Johnstown, Pa., 15, 18, 58
Jones, Talbot, 70
Juniata River, and mainline canal route, 57

Kane, John K., quoted, 60
Kiskiminetas Creek, and mainline canal route, 57
Kiskiminetas Valley, 16

Lancaster County, Pa., 50
Lebanon County, Pa., 50
Lehigh County, Pa., 50
Lincoln, Levi, 81–83, 86, 89
Liverpool and Manchester Railroad: 12, 22, 42, 61, 80, 89; financial operation of, and distance compared with canal, 29, 42–43, 48–49, 86, 91; physical operation of, 17, 29, 31, 48, 73; *see also* Rainhill Trials
Lockage, 64, 82; in Pennsylvania, 20–21, 30, 35-36, 59; *see also* canals
Locomotive, 6, 22, 28, 31–32, 37; *see also* railroads, railroad technology
London Courier, 31
London John Bull, 72–73
London Quarterly Review, 89
Loring, N. H., 52

McKay, Samuel, 88
Mainline, *see* Pennsylvania Mainline
Manchester and Liverpool, *see* Liverpool and Manchester
Maryland: and canal companies, 63, 67, 74; and organization of Potomac Canal Company, 49, 63; Trans-Appalachian trade of, 78; and turnpikes, 6; *see also* Baltimore; Chesapeake and Ohio Canal Company; Potomac Canal Company
Massachusetts, 80–96; and canal, 8, 13, 80–82, 85; Citizens Committee in, 86; commissioners in, 80-82, 89; and comparison with Baltimore, 9, 14, 80, 86; and comparison with Pennsylvania, 9, 14, 86; conservatism in, 86, 92–95; improvement leaders in, 12, 88; and railroad, 8–9, 13, 80, 83–84, 88–92, 94–96; and technical and cost criteria in decision-making, 84–86; timing of decisions in, 12; *see also* Boston
Massachusetts press, 80-96 *passim; see also* specific Boston papers
Mauch Chunk Railroad, 61; and effect on Carey, 73; and replacement of turnpike, 88
Merchants, in Baltimore and Philadelphia, 75; *see also* Baltimore; Philadelphia
Merrimack Canal, per-mile construction costs of, 36
Middlesex Canal, 5, 81, 86, 94
Miner's Journal, 27
Mississippi River, 6; and southwestern trade, 16
Mitchell, Nahum, 88
Monroe, James, 8 n. 9, 66
Moore, Thomas, 63
Morgan, R. F., 84
Municipal mercantilism, 14

National Road, 6
Newcastle to Carlisle Railroad, 86
New Jersey, and railroad, 61
New York Canal Commissioners, 21, 81
New York Canal Fund, surplus of, 6 n. 3
New York Central, 17
New York City, 6, 17, 81
New York and Erie Railroad, 17
New York State, 6, 8, 41, 81; *see also* Erie Canal
Niles' Weekly Register, and support of Chesapeake and Ohio Canal, 73, 75
"Northumberland," attack on portage railroad of, 53

Ohio Canal, 36
Ohio River, 6, 8–9, 16

Panic of 1837, in Massachusetts, 93
Patterson, Joseph W., 70
Patterson, Robert, 22
Patterson, William, 77
Pennsylvania, 15–62; and canal, 8, 13, 15–47, 57; and comparison with Baltimore, 9, 13, 51, 72; and comparison with Massachusetts, 9, 14, 51, 80; and depression of 1842, 59; geographic factors in, 6, 9, 40; and imitation, 14; industrial development of, 13, 16–17, 41, 55; internal improvement in, 12–13, 15, 19, 50; panic in, 56; and railroad, 12, 15–48, 50, 52, 59–60; timing of decisions in, 12; *see also* Pennsylvania Mainline; Pennsylvania Society; Philadelphia
Pennsylvania Canal Commissioners, 15-80
Pennsylvania Committee on Inland Navigation and Internal Improvement, report issued, 53
Pennsylvania House Committee, scepticism of railroad, 24
Pennsylvania Mainline, 15–60 *passim;* and canal decision, 15, 25, 38–41, 51–57; and canal-railroad debate, 21–47; costs on, 16, 39, 54; description of, 15–16, 58–59; difficulties of, 16–18, 49, 52, 59–60; geographic considerations of, 15; and industrial development, 15–16; interest in, 50, 55–57; profile map of, 10; and railroad factor, 15–16, 21, 28, 51–52, 60; *see also* Pennsylvania; Philadelphia
Pennsylvania Railroad Company, 15; chartered by legislature, 21; and early competition with New York Central and Hudson River Railroad, 17; impact on state industrial development of, 17; and incorporation of Philadelphia-Columbia Railroad, 60; opening of western division of, 60; and purchase of Pennsylvania Mainline, 60; subscriptions by local governments to, 59
Pennsylvania Society, 19; Acting Committee of, 19, 25, 28; and commercial interests of Philadelphia, 56; and fear of delay, 62; neutrality in canal-railroad debate of, 24, 28; publishing activities of, 20, 22, 28, 60; role of Carey in, 19; role of Philadelphia businessmen in, 19; *see also* Pennsylvania; Pennsylvania Mainline; Philadelphia
Perkins, Thomas H., 84
Perry County, Pa., 50
Phelps, Abner, 84
Phelps Committee, and relation to railroad in Massachusetts, 84–94 *passim*
Philadelphia: canal-railroad debate in, 19; compared with Baltimore, 63; geographic factors in, 74–75; internal improvement in, 6; lack of enterprise in, 16; and Pennsylvania Mainline, 15, 18; and railroad, 15, 18; trade in, 6, 9, 18–19, 56, 63–64; and turnpikes, 6; *see also* Pennsylvania; Pennsylvania Mainline; Pennsylvania Society
Philadelphia-Columbia Railroad, 59-60, 74; profile map of, 10

INDEX

Adams, Charles Francis, Jr., 89, 93
Adams, George W., and Phelps Committee, 84
Adams, John Quincy, 69
Albany, N. Y., 5; and trade with New York, 81
Alexandria, Va., *see* Potomac cities
Alleghenies, and canal tunnel, 6, 20–21; *see also* Trans-Appalachian projects
Allegheny River, and mainline canal route, 57
"Alnus," 42, 44 n. 111, 48 n. 134; and vested interests, 56
American Farmer, 61
American Railroad Journal, quoted, 78
Andrews Report, 94
Appalachians, *see* Alleghenies

Baldwin, James F., 89
Baldwin, Loammi, II, 80–88 *passim*
Baltimore, Md., 6, 63–75; canal interest in, 8, 12, 63–69, 73; and comparison with Massachusetts, 9, 14, 69, 80; and comparison with Pennsylvania, 9, 13–14, 63, 72–79; and decision for railroad, 8, 13, 48, 60, 63, 70, 72; geographic factors in, 9, 12, 64, 65; problem of internal improvement in, 6, 12–14; and trade, 6, 9, 63–67, 78; *see also* Baltimore and Ohio Railroad; Chesapeake and Ohio Canal; Maryland
Baltimore American, and canal-railroad debate in Maryland, 61, 73–76
Baltimore and Ohio Railroad, 17, 63–75; and finance, 71; and litigation with Chesapeake and Ohio Canal, 71; organization of, 63, 69–72, 75; origin of, 69–72; profile map of, 11; route described, 71
Baltimore Exchange, 77
Baltimore Gazette, 73, 75
Baltimore Patriot, 73, 75
Baltimore press, and railroad-canal isssue, 71, 73, 75; *see also* specific Baltimore papers
Bank of the United States, and non-renewal of charter, 93
Belmont Coal Mines, railroad proposed, 44
Berkshire County, Mass.: marble of, 86; railroad interest in, 84; trade of, 82
Bernard, General S., 67
Binney, Horace, 22
Birmingham and Liverpool Railroad, 22, 24, 31
Birmingham and London Railroad, 22
Bishop, Avard L., *State Works of Pennsylvania*, 51
Blackstone Canal, effects of, 90–91, 95
Board of Canal Commissioners, in Pennsylvania, 20–21, 25
Board of Internal Improvement of Massachusetts, creation of, 88–89
Boston, Mass., 80–96; and canal, 9, 14, 80–87; and railroad, 8, 18, 80–93; and trade, 6, 9, 95; *see also* Massachusetts
Boston and Albany Railroad, 18; formation of, 94; profile map of, 10; *see also* Boston and Worcester Railroad; Western Railroad
Boston Courier, 83, 88
Boston Daily Advertiser, 76, 82–83, 88, 95
Branch canals, *see* Canals; Maryland; Massachusetts; Pennsylvania
Boston and Lowell Railroad, 91–92
Boston and Providence Railroad, 92
Boston and Worcester Railroad, 91–94
Boston press, and railroads, 83; *see also* specific Boston papers
Brown, Alexander, 77–78
Brown, George, and Baltimore and Ohio Railroad, 70
Bryant, Gridley, 83, 87
Buckingham, Joseph T., 88
Buffalo, N. Y., 5–6

Canals: over Appalachian barrier, 6; costs of, 35–36; disadvantages of, 85; history, in America, 5, 42; in Maryland, 63–72; in Massachusetts, 80–96; in Pennsylvania, 29–60; portage issue in 38; and time required to move freight, 70; water vibration and speed of, 30; *see also* canal-railroad debate; Maryland; Massachusetts; Pennsylvania
Canal Commissioners, in Pennsylvania, 21–60 *passim*
Canal mania, 5–6, 13; and conflict with railroad in Pennsylvania, 52; in Maryland, 65–73 *passim; see also* Maryland; Massachusetts; Pennsylvania
Canal-railroad debate, 8; and economic development argument, 41; experience as crucial aspect in, 41–42; in Massachusetts, 80–87; in Pennsylvania, 29–52; in Potomac Valley, 63–72; technical and cost issues of, 29; velocity argument in, 31; *see also* canals, Maryland; Massachusetts; Pennsylvania; railroads
Canal tunnels: in Maryland, 64; in Massachusetts, 83; in Pennsylvania, 20–21, 35, 52; *see also* canals; Maryland; Massachusetts; Pennsylvania
Carey, William, and role in Pennsylvania Society, 15–61 *passim;* 82, 94
Carroll, Charles, 77
Central Committee, Washington convention, 64, 68
Champlain Canal, 61, 65
Charles River bridge, case of, 91
Chesapeake and Delaware Canal, project of, 50
Chesapeake and Ohio Canal, 8, 12, 19, 74; and analogy to Erie, 64; Baltimore participation in, 63-73 *passim;* chartered by Virginia, 66; and confirmation by Maryland legislature, 66; and confirmation by Pennsylvania, 66; financing of, 64–65; and litigation with Baltimore and Ohio Railroad, 71; national objectives of, 65; organization of, 64, 66, 72; profile map of, 11; *see also* U. S. Board of Internal Improvement, reports
Cincinnati, O., and turnpikes, 6
Cincinnati Commercial Register, 76
Clarke, James, 20
Cleveland, O., and turnpikes, 6
Columbia, Pa., 18
Committee of the Citizens of Boston, 85–86; *see also* Massachusetts
Committee of the Harrisburg Convention, *see* Harrisburg Convention
Committee on Internal Improvements of Maryland House of Delegates, 67
Committee of Sundry Citizens, *see* Sundry Citizens
Committee on Roads and Canals, Maryland, 68
Concord, N. H., internal improvement meeting in, 80
Conemaugh Valley, salt production in, 16
Corps of Engineers, survey by, 66; *see also* U. S. Engineers
Coulomb and Vince, experiments of, 46
Cumberland road, 19

Dearborn, Henry A. S., 80
Decision-making groups, psychological traits of, 12–14, 56–57, 75–80, 94–96; *see also* Improvement leaders
Delaware and Ohio Canal, suggested, 19
Delaware and Raritan, railroad proposed for, 61
Depression of 1842, in Pennsylvania, 59
Duane, William J., 26, 54

Economic development argument, in Pennsylvania, 13, 41; *see also* Pennsylvania
Edge rail, importance of, 34
Ellicott, Thomas, 67
England, *see* Great Britain
Erie Canal, 5–19 *passim;* and competition with proposed Potomac Canal, 53; cost of, 35–36, 65, 86; and economic development of New York, 33, 39; and effect in Baltimore, 76, 78; and effect in Massachusetts, 80–81, 86–87; and effect in Pennsylvania, 48–50; lockage on, 52; profile map of, 10, 11; risks in decision for, 41; success of, 6, 50, 81, 86, 94; and trade, 16, 65
Eustis, William, Governor of Massachusetts, and canal, 80
Evans, Oliver, prediction on railroads of, 75
"Examiner," opponent to Carey, 34, 42, 44 n. 109, 55–56

Facts and Arguments, 26–56 *passim*, 91
Federal aid, for Chesapeake and Ohio Canal, 64
Frederick, Md., canal agitation in, 67
Friction, and railroad speed, 30, 46
Friction wheel, invention of, 77, and use on railroad, 33

Gallatin, Albert, 19; report of, 54, 66
Geddes, James, 69, 72
Georgetown, Va., and canal route, 64; *see also* Potomac cities
Girard, Stephen, 22
Granite Railroad, 12, 61, 73, 83–88 *passim*
Great Britain, and railroad: experiences with, 6–8, 37; finances of, 35, 38, 42; prediction of boom in, 43; *see also* railroad; railroad mania

Hale, Nathan, 82–95 *passim*
Hampshire County, Mass., 86
Harper, Robert Goodloe, 65, 74
Harrisburg, Pa., convention, and Pennsylvania Mainline, 20, 25, 36, 44, 46, 49, 51, 55, 59
Hartz, Louis, *Economic Policy and Democratic Thought*, 51
Henshaw, David, 83
Holgate, Jacob, 20
Hollidaysburg, Pa., 15, 18, 58
Housatonic Valley, 82
Howard, Benjamin C., 70
Howard, John Eager, 70
Howard, William, 71
Hoyt, Elihu, 80
Hudson River Railroad, 17
Hunt's Merchants' Magazine, 40

Improvement leaders: in Baltimore, 75–79; in Massachusetts, 80, 88; in Pennsylvania, 52, 56, 60
Improvement propaganda in Pennsylvania, 50; and comparison with Baltimore, 65, 75
Ingersoll, Charles J., 25–26
Internal improvement, *see* Baltimore; Boston; Philadelphia
Internal improvement convention: at Harrisburg (*see* Harrisburg Convention); at Washington (*see* Central Committee)
Interregional railroads, *see* specific railroad lines

Jessop, William, English engineer, 32, 34, 42
Johnstown, Pa., 15, 18, 58
Jones, Talbot, 70
Juniata River, and mainline canal route, 57

Kane, John K., quoted, 60
Kiskiminetas Creek, and mainline canal route, 57
Kiskiminetas Valley, 16

Lancaster County, Pa., 50
Lebanon County, Pa., 50
Lehigh County, Pa., 50
Lincoln, Levi, 81–83, 86, 89
Liverpool and Manchester Railroad: 12, 22, 42, 61, 80, 89; financial operation of, and distance compared with canal, 29, 42–43, 48–49, 86, 91; physical operation of, 17, 29, 31, 48, 73; *see also* Rainhill Trials
Lockage, 64, 82; in Pennsylvania, 20–21, 30, 35-36, 59; *see also* canals
Locomotive, 6, 22, 28, 31–32, 37; *see also* railroads, railroad technology
London Courier, 31
London John Bull, 72–73
London Quarterly Review, 89
Loring, N. H., 52

McKay, Samuel, 88
Mainline, *see* Pennsylvania Mainline
Manchester and Liverpool, *see* Liverpool and Manchester
Maryland: and canal companies, 63, 67, 74; and organization of Potomac Canal Company, 49, 63; Trans-Appalachian trade of, 78; and turnpikes, 6; *see also* Baltimore; Chesapeake and Ohio Canal Company; Potomac Canal Company
Massachusetts, 80–96; and canal, 8, 13, 80–82, 85; Citizens Committee in, 86; commissioners in, 80-82, 89; and comparison with Baltimore, 9, 14, 80, 86; and comparison with Pennsylvania, 9, 14, 86; conservatism in, 86, 92–95; improvement leaders in, 12, 88; and railroad, 8–9, 13, 80, 83–84, 88–92, 94–96; and technical and cost criteria in decision-making, 84–86; timing of decisions in, 12; *see also* Boston
Massachusetts press, 80-96 *passim; see also* specific Boston papers
Mauch Chunk Railroad, 61; and effect on Carey, 73; and replacement of turnpike, 88
Merchants, in Baltimore and Philadelphia, 75; *see also* Baltimore; Philadelphia
Merrimack Canal, per-mile construction costs of, 36
Middlesex Canal, 5, 81, 86, 94
Miner's Journal, 27
Mississippi River, 6; and southwestern trade, 16
Mitchell, Nahum, 88
Monroe, James, 8 n. 9, 66
Moore, Thomas, 63
Morgan, R. F., 84
Municipal mercantilism, 14

National Road, 6
Newcastle to Carlisle Railroad, 86
New Jersey, and railroad, 61
New York Canal Commissioners, 21, 81
New York Canal Fund, surplus of, 6 n. 3
New York Central, 17
New York City, 6, 17, 81
New York and Erie Railroad, 17
New York State, 6, 8, 41, 81; *see also* Erie Canal
Niles' Weekly Register, and support of Chesapeake and Ohio Canal, 73, 75
"Northumberland," attack on portage railroad of, 53

Ohio Canal, 36
Ohio River, 6, 8–9, 16

Panic of 1837, in Massachusetts, 93
Patterson, Joseph W., 70
Patterson, Robert, 22
Patterson, William, 77
Pennsylvania, 15–62; and canal, 8, 13, 15–47, 57; and comparison with Baltimore, 9, 13, 51, 72; and comparison with Massachusetts, 9, 14, 51, 80; and depression of 1842, 59; geographic factors in, 6, 9, 40; and imitation, 14; industrial development of, 13, 16–17, 41, 55; internal improvement in, 12–13, 15, 19, 50; panic in, 56; and railroad, 12, 15–48, 50, 52, 59–60; timing of decisions in, 12; *see also* Pennsylvania Mainline; Pennsylvania Society; Philadelphia
Pennsylvania Canal Commissioners, 15-80
Pennsylvania Committee on Inland Navigation and Internal Improvement, report issued, 53
Pennsylvania House Committee, scepticism of railroad, 24
Pennsylvania Mainline, 15–60 *passim;* and canal decision, 15, 25, 38–41, 51–57; and canal-railroad debate, 21–47; costs on, 16, 39, 54; description of, 15–16, 58–59; difficulties of, 16–18, 49, 52, 59–60; geographic considerations of, 15; and industrial development, 15–16; interest in, 50, 55–57; profile map of, 10; and railroad factor, 15–16, 21, 28, 51–52, 60; *see also* Pennsylvania; Philadelphia
Pennsylvania Railroad Company, 15; chartered by legislature, 21; and early competition with New York Central and Hudson River Railroad, 17; impact on state industrial development of, 17; and incorporation of Philadelphia-Columbia Railroad, 60; opening of western division of, 60; and purchase of Pennsylvania Mainline, 60; subscriptions by local governments to, 59
Pennsylvania Society, 19; Acting Committee of, 19, 25, 28; and commercial interests of Philadelphia, 56; and fear of delay, 62; neutrality in canal-railroad debate of, 24, 28; publishing activities of, 20, 22, 28, 60; role of Carey in, 19; role of Philadelphia businessmen in, 19; *see also* Pennsylvania; Pennsylvania Mainline; Philadelphia
Perkins, Thomas H., 84
Perry County, Pa., 50
Phelps, Abner, 84
Phelps Committee, and relation to railroad in Massachusetts, 84–94 *passim*
Philadelphia: canal-railroad debate in, 19; compared with Baltimore, 63; geographic factors in, 74–75; internal improvement in, 6; lack of enterprise in, 16; and Pennsylvania Mainline, 15, 18; and railroad, 15, 18; trade in, 6, 9, 18–19, 56, 63–64; and turnpikes, 6; *see also* Pennsylvania; Pennsylvania Mainline; Pennsylvania Society
Philadelphia-Columbia Railroad, 59-60, 74; profile map of, 10

Philadelphia Democratic Press, quoted, 60
Philadelphia National Gazette, 22
Philadelphia press, 22-25, 42-45; and railroad developments, 22; *see also* specific Philadelphia papers
Philadelphia Select and Common Councils, Joint Special Committee, 18–19
Philadelphia United States Gazette: and Pennsylvania Mainline, 22–29 *passim*, 38–49 *passim*
Pittsburgh, Pa.: importance of Pennsylvania Mainline to, 15, 16; and mainline canal route, 57; and turnpikes, 6
Pittsburgh Gazette, quoted, 48
Pittsburgh Pike, 6
Portage railroad: 8; in Massachusetts, 85; in Pennsylvania, 30–59 *passim; see also* Pennsylvania Mainline; railroads
Porter, James M., anti-railroad speech of, 52
Potomac Canal Company: organization of, 20, 63, 64; *see also* Chesapeake and Ohio Canal Company
Potomac cities: and canal mania, 72; and jealousy of Baltimore, 67
Potomac River, 63
Potomac Valley: canal versus railroad in, 63–72; characteristics of, 74
Proprietors of the Massachusetts Canal, 80
Pro-railroad sentiment, rapid development of, 60

Quincy, Josiah, 88
Quincy, Mass., 12
Quincy Railroad, *see* Granite Railroad
Quincy-to-Neponset line, *see* Granite Railroad

Railroad: advantages of, 8, 29–30; over Berkshire Mountains, 9; characteristics of, 17, 29; and costs compared with canal, 29–31, 35; disadvantages of, 33; and distinction between "private" and "public," 44–45; experience record of, 24, 77; general purpose, lack of experience with, 31, 33-34, 48, 77; history in Potomac Valley of, 63–72; inclined planes on, 17-90 *passim;* in Maryland, 63–79; in Massachusetts, 81-90; and New Jersey, 61; to Ohio River, 8; in Pennsylvania, 15-60; private, 32, 48; problems of, in U. S., 23–24
Railroad-canal debate, *see* canal-railroad debate
Railroad mania: in Great Britain, 22, 27; in Maryland, 13, 75-77; in Pennsylvania, 43–46
Railroad technology, 6–8, 47, 70; effect in Pennsylvania of, 17–37; innovations in, 23, 33, 48, 71–77 *passim;* on Baltimore and Ohio, 71–78; and grades, 32–33; on Granite, 87
Rainhill Trials, 17, 48, 73-94; *see also* Liverpool and Manchester
Roberts, Nathan S., 69, 72
Robinson, Moncure, 58

Sargeant, Henry, 85
Sargeant, John, 55-56, 65
Schulze, Governor John A., 57, 62
Schumpeter, Joseph, quoted, 12-13
Schuylkill-Delaware Canal, 22
Schuylkill Navigation, 20; adequacy of, 50; per mile construction costs of, 36
Slatter, Charles L., 59
State Bank of Massachusetts, 93
Stationary engines, 17–87 *passim; see also* railroad technology
Steamboats, and western trade, 6, 21, 78
Stephenson, George, 22
Stevens, John, 21-55 *passim*, 83
Stevenson, Robert, 22, 42
Stockton and Darlington Railroad, 8, 22–48 *passim*, 69–89 *passim*
Strickland, William: and effect in Maryland, 70–72; and locomotive, 91; and Pennsylvania Mainline, 15–60 *passim*
Subsidies, 13; *see also* Maryland; Massachusetts; Pennsylvania
Sullivan, John L., 66
Sundry Citizens Committee, and railroad in Baltimore, 70–91
Surrey Railroad, 8, 45, 61
Survey Act, federal passage of, 66
Susquehanna and Juniata canal route, 20
Susquehanna River, 15, 57

Taylor, George Rogers, 5
Technology, *see* railroad technology
Thomas, Evan, 69
Thomas, Philip E., 70-71, 79
Tolls, 21-22; on Baltimore and Ohio Railroad, 71; of canal companies, 43; as measure of benefits, 41
Tonnage tax, imposed on Pennsylvania Railroad, 59
Totten, Lieutenant-Colonel, 66
Trade, 8, 16; *see also* Baltimore; Massachusetts; Pennsylvania
Trans-Appalachian projects, 17, 63; profile maps of, 7, 10-11
Transportation costs, per pound, 30
Transportation lines, and developmental returns, 87
Transshipments, problems of, 16–18
Trcziyulney, Charles, 21, 72
Tredgold, Thomas, 37–38, 44–45, 61
Tunnels, *see* canal tunnels
Turnpikes, advantages of, 6; *see also* Maryland; Massachusetts; Pennsylvania
Two-way trade, 6

Union Canal, 16, 20–57; costs of, 36; inadequacies of, 8, 64; and Pennsylvania Mainline, 51-74; replacement of, 15, 58
Union County, Pa., 50
United States Board of Internal Improvement: effect in Baltimore of, 72–74; estimates of, 70; reports of, 66–68
United States Engineers, 49, 71–72

Velocity, in canal-railroad debate, 31, 47; *see also* canals; railroads
Virginia: and Potomac Canal Company, 20, 49, 63; and turnpikes, 6; *see also* Chesapeake and Ohio Canal
Virginia Board of Public Works, creation of, 63
Virginia General Assembly, 63

Washburn, Emory, and Phelps Committee 84–87, 95
Washington, D. C., internal improvement convention in, 64; *see also* Central Committee; Potomac cities
Water power, 23
Water vibration, and speed of canals, 30
Western Railroad: description of, 91–95; route of, 84
Western trade, competition for, 8
Wheeling, W. Va., 6
Willis, Nathan, 80
Wilson, John, U. S. Topographical Engineers, 59
Winans, Ross, and invention of friction wheel, 77
Winchester, George, 66
Worcester, Mass., 80